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LOST TO HIS COUNTRY . . .
PRINCE ALBERT

BY his untiring efforts as Sponsor of the Great Exhibition of 1851; as President of the British Association for the Advancement of Science; as active patron of the Society of Arts, "Albert the Good", beloved Consort of Queen Victoria, did much to direct the application of science and invention to the betterment of the everyday life of his adopted countrymen

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Discussion of all papers is invited

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A SUGGESTED WATER WORKS COLLECTION PROCEDURE

By M. F. Hoffman

(Commercial Superintendent, Department of Water Works, Cincinnati, O.)

In water works practice we have the happy balance between pumping and consumption. Through adequate controls we can regulate our pumping engines to meet the consumers' requirements.

Services are maintained at standard through crews working in three eight-hour shifts. Supply and distribution costs are constantly being lowered as newer and bigger pumping engines and better means of purification and large trunk feed lines are replacing obsolete methods and means.

Operating and engineering functions in water works have kept pace with all the improvements made in those fields. However, when we consider that the revenues to bear these costs of operation and betterments must come from the sales of water it is high time to analyze our Commercial Divisions which, in only too many instances, are following the crude methods of our predecessors.

As long as revenues from water sales exceeded the cost of operation there was no urgent reason for any modernization. As volume of meter reading, meter inspections, accounting and collections increased more man power was added.

But with the ever-growing demand for lower utility rates it has

become mandatory to provide for handling this volume at lower costs. And the solution to this has been found in the installation of sound business procedure supplemented by modern business equipment.

BASES OF COLLECTION SYSTEM

To suggest a collection system to meet every condition in every locality is surely striving for Utopia. There is no reason, however, why a practical procedure cannot be outlined, subject to the flexibility required to adapt it to particular needs.

First of all, the reading of meters and billing of consumers' accounts should depend on the responsibility for payment. In those states where water charges are a lien against the property, meters should be read and billed quarterly. Where the property does not serve as surety, the meters should be read and billed monthly, as a precaution against large losses on uncollectible accounts.

It is obvious that the former method is the more desirable. Accounts may then be kept by premises and progress continuously regardless of succession of ownership or occupancy.

Most municipal water works use the quarterly billing plan, due to the high cost of billing the large number of small users monthly. Obsolete methods provided for ledger accounting without controls and preparation and delivery of bills by hand.

With the advent of business equipment rapid changes were in order. Addressing machines, capable of reproducing 7,500 complete addresses accurately from metal plates per hour, are the vital means of skeletonizing all records. Meter books are used in the field and later form the media for billing. This billing is completed on machines with a capacity of 1,800 to 3,500 bills per day. On each is shown dates of readings, the readings, consumption and amount. The machines accumulate the total consumption and billing charges which, when posted to a proof sheet, form a bookkeeping entry for control.

The old cumbersome ledger has also been abolished. A three-part bill, addressographed and completed by machines, becomes a bill, office ledger record and delinquent notice. The use of these machines further suggests a staggered billing schedule so that there is a uniform flow of work, keeping the machines in maximum use with a minimum of personnel.

To illustrate, it is desirable to depict Cincinnati's procedure.

CINCINNATI WATER WORKS BILLING PROCEDURE

Meters are read quarterly for approximately 94,000 accounts. The only exceptions are on about 18,000 accounts located in the basin, or older part, of the city, where it is advisable to read these meters monthly to protect non-resident owners against leaks or excess consumption; and 1,800 commercial or large users, where it is desirable to read the meters monthly and bill them on the same basis.

Consumers' meter records are maintained on loose-leaf sheets, kept in binders, and these binders are taken into the field on prescribed scheduled reading dates. The meter reading is noted, together with any special circumstances concerning irregular reading, and upon their return to the office the consumption is computed and the amount extended for billing purposes.

Bills are addressographed on a post card bill comprising three units, namely: office record, post card bill and delinquent notice. The delinquent notices are severed from bill and office record, and filed until required. The office record and bill are completed on so-called public utility billing machines from meter book, at which time a duplicate copy of the bill is made up as a sales sheet. The sales sheet is used for auditing purposes and for billing control.

When the bills are ready for mailing, the bill portion is severed from office record and mailed, after unpaid balances have been carried forward, under a one-cent first-class postal permit, while the office records are placed in accounts receivable file and the accounts clerk charged for the amount of the bills from sales sheets.

Payments when received are represented by the small cashier stubs, which are first balanced by the cashier, and then distributed into billing zones, the total of which distribution balances with the cashier's total. The stubs are then given to the accounts clerk, where they are sorted in numerical sequence and corresponding office record removed from the unpaid file. These office records are totaled and must agree with the distribution of the cashier's amount, after which they are stamped with the date of payment and filed in numerical sequence in the paid file. The cashier's stubs are then returned to the distribution clerk for filing.

The 94,000 accounts are distributed into nine billing periods and bills generally are rendered quarterly, on the 5th, 15th and 25th of each month, allowing ten days for payment, maturing on the 15th, 25th, and on the 5th of the ensuing month, respectively. If not paid by those dates, the delinquent notice is mailed, giving a new date for

payment, on the 25th, 5th and 15th, respectively, and if not paid by those dates a penalty of $1.00 in the city, and of $1.50 in the county, is added, and the accounts given to turnkeys for collection or discontinuance of service.

The accounts clerks balance with the bookeeper shortly after the turnkey period has been closed, when the number of stubs representing unpaid accounts approximates less than one-half of one percent of the number of accounts rendered. Further, it might be added that the accounts clerk can balance at any time under this plan, check his records up to date, and each day's work is proven as it proceeds.

Additional modern equipment has been installed, such as an electric opener, which takes care of our mail in approximately 15 minutes per day, as against three hours per day manually; a check indorsing machine, which automatically indorses checks while the bank deposit is being prepared; a number of register machines for writing on and off orders, replacing the multiplicity of operations formerly required for these purposes, and a postage meter machine which saves the trouble of stamping and gives us accurate control on the number of bills and delinquent notices mailed.

POSSIBILITIES OF CINCINNATI METHOD

As paid accounts are eliminated, there are only unpaid accounts to handle. The best thing we do with these is collect them. After the second or final date has expired delinquent bills in triplicate on fan-fold forms are prepared on typewriters, to include the collection charge. The top, or blue copy, goes to the cashier's office; the second, or gray, copy to the turnkey foreman; and the third, or white copy to the turnkey.

As the accounts are paid, the three copies are matched to prevent duplication of effort. When paid to the cashier, he stamps the blue copy "paid" and forwards to turnkey foreman who removes gray copy from his file and obtains white copy from turnkey. These are retained for 30 days and then destroyed. When paid to the turnkey, he passes the white stub and remittance to the turnkey foreman who in turn destroys his gray copy and receives back from the cashier the blue copy stamped "paid."

The above plan is ideal for large bills and indigent consumers. It permits of the fullest coöperation with the consumers and has done more, in my opinion, to sell the water works to its patrons than any other means. By stub plan of consumers' accounting we arrange for

partial payments and encourage this practice as it solves the problem of well-meaning consumers on reduced income. It entails no additional cost to render this service and promotes a spirit of good will between the Water Works employee and consumer which is highly desirable.

We believe that Cincinnati has solved the problem by flexible accounting procedure which enables us to meet all reasonable demands made by consumers. At the same time the property owner is protected through considerate enforcement of collections on the premises. With the assistance of the Board of Health which is notified in the event of a shut-off, no insanitary conditions are allowed to prevail.

In addition to expediting the work and permitting of closer public contact the system described in the foregoing resulted in a saving of $125,000.00 per year and was instrumental in passing along to consumers a substantial reduction in water rates.

THE FINANCIAL HISTORY AND PRESENT FINANCIAL POLICY OF THE WATER DEPARTMENT OF CINCINNATI, OHIO

By A. S. Hibbs

(Superintendent, Department of Water Works, Cincinnati, O.)

Public ownership of the water supply system of the City of Cincinnati dates back to the early 19th Century, when private operation proved unsatisfactory and costly.

An Ordinance passed March 31, 1817, provided

"That the Cincinnati Mfg. Co., their heirs, successors and assigns to, and they are, hereby vested with the exclusive privilege of conveying water, by tubes or otherwise, from the Ohio River, through the streets, lanes, alleys and commons of the Town of Cincinnati, for the purpose of supplying the inhabitants of said Town therewith; which privilege may and shall be enjoyed by said Company, their heirs, successors and assigns, as aforesaid, for the term of ninety-nine years from and after the passage of this Ordinance."

This Ordinance provided for the free use of water for fire and for the payment of One Hundred ($100.00) Dollars per year to the town.

In 1824, after considerable expenditures had been made to install new steam pumps and make several pipe extensions, the owner was financially embarrassed and offered to sell the entire Works to the City for $30,000.00. A Council Committee investigated the subject and presented a long report, recommending the purchase of the Works by the City. The proposal was submitted to a vote on March 3, 1824, and lost 294 to 25.

In 1832, after fire had destroyed the pumps and part of the station, putting the City out of water for over three weeks, a second effort was made to have the City purchase the plant for $150,000.00, but the proposition was again defeated by a vote of 617 to 303.

A third attempt was also made 1836, but again failed to carry an election.

In 1838, the Company raised the rates over 20 percent, which created such general indignation that at an election held in October of that year, a large majority favored the purchase, the vote being 1573 in favor of the purchase and 521 against it.

The State Legislature in 1839, passed an Act, authorizing the City to borrow $300,000.00 at 6 percent to purchase the Water Works.

In June, 1839, the City took possession, paying $300,000 in City Bonds bearing 6 percent interest and redeemable in 1865.

For the purpose of equalizing the water tax, the City Council in 1860 passed an ordinance, prepared by R. B. Hayes (afterward President of the United States), assessing a tax of 10 cents per foot front on all property abutting on streets in which water mains were laid. Two years later this ordinance was repealed, and the Council, in lieu thereof, assumed the payment of interest on outstanding Water Works Bonds, which was done until 1878, from which time the Water Works has assumed this obligation.

Another unusual phase of water works financing took place in the late 1890's, when the State Legislature passed the Water Works Act, ordering the Governor of Ohio to appoint a Board of Trustees as Commissioners of Water Works, for the purpose of issuing bonds and constructing works which would provide an abundant supply of pure and wholesome water.

This Board was immediately enjoined from exercising its duties until the validity of the Act had been judicially determined. The case was carried to the Supreme Court of the State, who rendered a decision in 1897 sustaining the validity of the Act.

This Board of Commissioners issued over $10,000,000 in Bonds at an average rate of 3.67 percent interest for the construction of the new water works.

New bonds were issued in small sums and at increasing interest rates until 1920, when an issue of $400,000, providing for an interest rate of 6 percent and a life of only 20 years without option or call period, caused a change in policy.

For ten years no bonds were issued for improvements, all construction being paid for from income.

A decided change in policy from the usual was thus induced by the unfavorable borrowing experiences of 1920, and during the next ten years about $5,000,000 was expended for various improvements, including large pumps, reservoirs and high service tanks, directly from revenues derived from sales of water.

When business and private incomes were reduced due to the depression, this policy of paying for permanent improvements from income was severely questioned by those in charge of the City's financing.

It was argued that the present generation of water users should not be required to pay high water rates to finance improvements that would be used by future users, but that the cost of permanent improvements should be spread out over the life of the improvements, and that water rates should not be greater than necessary to pay the operating costs of the department and the carrying charges of loans.

The following extract from a report by the Superintendent of the Water Works, dated April 18, 1930, gives some very interesting arguments in favor of the "Pay-as-you go" plan.

> "In 1919, when the last change in rates was made, on account of the large increase in the cost of labor and supplies, it was considered best to make the rate such that the receipts would meet, not only the costs of operation and maintenance and existing fixed charges, but would produce a surplus sufficient to finance improvements, extensions and betterments of the plant which will be necessary from time to time."

Among the improvements which have been made under this policy may be mentioned, the relining of both basins of the Eden Park Reservoir; an eight million gallon pump at the Western Hills Station; the reconstruction of the Mt. Auburn Tanks; the New Eastern Hills Reservoir on Winton Road; the Mt. Airy Tanks; several miles of trunk mains and the replacement of over forty miles of old 3-and 4-inch mains.

The total value of improvements made since 1920 from receipts is $4,261,988.86. Had bonds been issued for these betterments, the debt would now have been $19,174,219.34 and the interest and sinking fund payments would have been increased from $779,992.87 to $1,112,428 per year, which is over 39 percent of the total receipts from all sources during the year 1929.

The figures fully justify the wisdom of the policy of pay-as-you go, adopted in 1919 and should without further argument result in a continuation of this method of financing the ordinary water works improvements.

This plan of financing water works improvements has received very favorable comment from both the press and the public. On page 21 of "Municipal Activities" for the year 1928, the following statement was featured as one of the savings and accomplishments:

> "Water works revenue sufficient for all capital improvements without issuing Bonds."

Again on page 74 this was emphasized in bold type as follows:

"The revenues are now and have been such since the year 1920, sufficient to meet all expenses including all improvements without the issuing of any bonds."

I am very proud of these two statements and hope to see them repeated for many years.

The Statutes of the State of Ohio limit the amount of Bonds which may be issued by a municipality and while these restrictions do not apply to bonds issued for water works purposes, the principle is sound. An unreasonable debt on the water works would reflect upon the value of other City bonds.

For all borrowed money on a twenty year bond plan, there must be secured, within the life of the bonds, two dollars for every dollar borrowed, one for repayment of principal, one for interest.

It does not seem reasonable to borrow money for improvements when the amount needed is on hand, in cash, drawing a lesser interest than the rate for which bonds could be issued.

The use of the present surplus to retire new water works bonds and borrowing money for present needs, would be retiring 3 to 4 percent bonds and issuing new ones at about 4½ percent—a rather unusual method of refunding a debt.

There has never been a valuation of the plant and equipment. The making of such a valuation would be a large undertaking and would entail a large expenditure for expert services and would accomplish no real benefit. In a privately owned utility, where the question of a fair return upon capital enters largely into the making of rates, there is some reason for carrying such an account and it is usually kept at a maximum.

There is no account set up for depreciation for the reason that the major improvements, consisting of the building of the new plant and a large portion of the distribution system was financed from bond issues. The interest and sinking fund charges have been and are being paid from receipts.

If during the life of these bonds a depreciation account is also set up, the value of the improvement would be collected for twice during the life of the improvement. In other words, the original cost would be met by sinking fund payments and at the end of the period the amount in the depreciation fund would be also equal to original cost. A depreciation fund would be also equal to original cost. A de-

preciation fund is only justified where improvements are paid for in cash.

Whether the ordinary improvements are financed from a fund known as a depreciation fund, from receipts, from surplus or from balances, seems immaterial.

Other than a few of the very large water users, there has been no general complaint, nor a request for a reduction.

About 15 percent of the water consumers now pay the minimum charge of 40 cents per month and fully 75 percent pay less than $1.00 per month.

The reduction to 75 percent of the consumers even at a 10 cent rate would be but a few cents per month. There is some justification in a reduction for large consumption, but none for any reduction of the minimum bill."

However, in 1931, water rates were reduced about 10 percent from a straight 12 cents to a sliding scale with the lowest step at 5 cents per 100 cubic feet for the largest monthly consumption.

In lieu of depreciation, funds were appropriated from revenues for the materials used in an extensive replacement program, and in four years over 80 miles of 3- and 4-inch mains have been replaced with larger mains by use of such appropriations.

Bonds were issued during this period to pay the contracted labor costs on these replacements, as well as for the installation of new mains and new equipment.

Since 1930, about $800,000 in Serial Bonds at interest rates of 4 and 4½ percent have been issued for such purposes, all of which have been purchased by the Sinking Fund Commission, or Municipal Retirement system.

Even at the lowered water rates, cash balances during the past two years have grown, due to drought conditions which increased sales of water and to economies put into effect in the department.

This made possible the immediate participation in Federal Public Works Administration financing, to the extent of $536,000 worth of large feeder mains, the Government Grant of 30 percent being used as part of the contract payments.

Funds have also been available, due to excess cash balances, to call and pay off certain old bond issues to the extent of $1,800,000 in 1934 and over $500,000 in 1935.

The total gross bonded indebtedness, December 31, 1934, was $12,389,530, against which the Sinking Fund Commission held a

credit of $7,886,957, so that the total net indebtedness of the department at the beginning of this year was $4,502,573.00, against a total valuation of about $28,000,000.

During the last few months, a new thought has been brought into the picture regarding municipal financing, and that is, that all incomes for all City Departments, whether from taxes, gasoline, allocations or water rents, should be maintained high enough to create a City fund, from which all City improvements, other than those assessed directly against property, might be financed.

The one draw back to the "Pay-as-you-go" plan is the fact that it is hard to make piece-meal improvements in water works structures.

When the New Water Works was completed in 1907, it had a capacity of 120 million gallons per day, far in excess of the actual demand at that time, but the economy of such construction has been made more and more evident as the years have advanced, since no major additions have been required for almost 30 years.

The Department is now faced with the necessary expansion of the filtration plant of this 30 year old system, and it seems most advisable to build with the probable consumption of future years in view.

Our latest plan contemplates the complete reconstruction of certain units of this plant, and the rehabilitation of other units, which can be incorporated in a new plant, the ultimate capacity of which, is considered to be 250 million gallons per day.

The total expenditure for this new plan will be about $3,000,000 and it will be impossible for the water department to finance such a large amount at one time from water revenues.

It is hard to state at this time, just what the future policy in financing may be, since the Federal Government has entered the picture with the possibility of loans or grants, which as yet have not been fully outlined.

The Cincinnati Water Department is in a position, however, to take almost immediate action on any plan that may be presented.

SALES TAXES IN RELATION TO WATER UTILITIES

By Dale L. Maffitt

(General Manager, Water Works, Des Moines, Ia.)

In recent years a national effort has been made to find a source of revenue that would bridge the chasm between public expense and public income. The reduction of government expenditures by means of recent tax limitation laws in various states has proven inadequate and often undesirable. In some cities schools have been temporarily closed; in Cleveland every other street light was turned off; in Seattle a 6 percent tax was imposed on the gross income of the municipal water department; in Iowa taxing districts were required to levy less than 65 percent of the amount levied in 1930. Many cities have had to issue deficiency bonds and others have been entirely unable to balance their budgets.

It was perhaps an inevitable development of opinion that because of an ever-increasing tax burden upon visible property, a burden which such property became less and less able to bear as the depression progressed, some new and substantial sources of tax revenue must be found for the various states that without materially increasing the total tax load would increase the tax base by spreading the tax burden to include those who in the past had not been paying direct taxes. The sales tax in many cases has been the result.

At the beginning of 1933 only two states in the union had a retail sales tax, and by the beginning of 1935 nearly one-half of the states had enacted such a tax in one of its forms.

There also seems to be a tendency toward more comprehensive state tax laws, including often a tax on the sale of water to consumers by water utilities. Pennsylvania, for instance, (whose sales tax law incidentally was enacted for a period of six months and is not now in effect) has before its state legislature at the present time a bill providing for a levy of 2 percent on the gross receipts of water companies, whether or not they are municipally owned (1). The more usual method of obtaining this revenue for the state is through the sales tax.

Different states have various methods of applying the sales tax. Rhode Island, for instance, levies a flat amount on certain services, such as 5 cents on each gas or electric bill when not over three dollars per month and higher amounts for larger bills. Many recent enactments impose a tax of a certain percent on the gross receipts or gross income from the sales of tangible personal property and the furnishing of gas, electric, water and communication service when sold at retail to consumers, regardless of whether or not the properties are owned privately or publicly.

The rate of tax varies from 0.5 percent in Missouri to 3 percent in Kentucky, Ohio, Michigan and North Carolina. Two percent is the most common rate.

As the tax is on gross receipts or gross income over a period of time and obviously cannot be on the individual item of sale, the state has performed its lawful duty when it has collected a flat rate of percent on the gross sales; however, as it is often the intention that the tax or the average equivalent thereof be passed on to the consumer as far as practicable, it usually becomes necessary to arrange some means by which the retailer may collect on each sale. For this purpose the "bracket system" is most often used with brackets similar to the following:

Purchases up to 15 cents—no tax
Purchases from 15 to 65 cents inclusive—1 cent tax
Purchases from 66 to 99 cents inclusive—2 cents tax
Purchases of one dollar and more—straight 2 percent tax, governed by major fractions (2)

The brackets here mentioned are obviously based on a 2 percent tax.

Ordinarily the income from this system will be very close to the desired amount. Particularly is this true for utility bills, which average over one dollar each.

There are also other methods of shifting the tax to the consumer—such as the Ohio tax stamps, and the California tokens and systems of punch cards, all of which allow for more accurate payment of the levy by providing for the fractions of a cent.

As the responsibility of collecting the tax rests with the seller, he must either assume the entire payment himself similar to the payment of his rent or he must provide the procedure for collecting from the ultimate user and bear the expense incident thereto. This expense in

the case of the water works will be the result of three general operations:

First, a record and tabulation of each amount charged must be kept. Where billing machines are used an additional register will be necessary on the machine.

Second, the amount of the tax should be separately shown on the bill and totaled with the other items. Experience has indicated that it is desirable to have plainly marked on all bills that the amount indicated is for the specific tax mentioned, and thus avoid popular confusion (3).

Third, the amount of the tax to be paid by each consumer must be calculated. If there is a meter rental, service charge or deposit charge made upon which the state law does not impose the tax, this amount must be deducted before applying the levy.

While the seller is held responsible for the collection of the retail sales tax, there is evidence that the state will support the seller's right to collect. The Mississippi supreme court refused to compel a public utility company to resume service discontinued for non-payment of a bill where a patron deducted the amount of a disputed sales tax proposed to be passed on by the utility to its consumers. The customer had tendered the amount of the bill less the tax and demanded a receipt in full. The company refused to give such receipt, since this would have precluded it from collecting the sales tax from other customers, as it was required by law to serve all consumers on the same terms (4).

In order to make the sales tax popular it has seemed desirable to hold the cost of administration as low as possible. Some states have even determined by the law the maximum that can be spent for the purpose. This has resulted, particularly with the more recent enactments, in the omission, as far as practicable, of all exceptions and exemptions that would be likely to increase the cost of administration.

Most exemptions from state sales taxes may be divided into four main classes: first, those according to businesses or individuals, in a lump sum—for example, $600 a year in Michigan and $1,000 a year in Indiana; second, sales of commodities already subject to other special taxes—for example, gasoline, cigarettes, etc.; third, special classes of businesses or sales—for example, sales by farmers, incidental sales, and sales to relief agencies; fourth, sales not legally taxable by states—for example, interstate sales and sales to or by the federal government (5).

Exemptions of the fourth class are the most important to water utilities and cannot legally be omitted if they definitely fall in this class; however, that sometimes is doubtful, and special interpretations and rules may become necessary in applying them. Such a rule was made by the taxing board for the state of Iowa in regard to water and ice purchases made by railroads involving interstate business. It was ruled that where the exact amount purchased cannot be divided between interstate and intrastate commerce 90 percent of the total purchases will be considered as used in interstate commerce and the tax will be assessed on the remaining 10 percent of the total (6).

States do not seem to agree on the definition of a retail sale. In most states a sale is considered taxable if the material sold does not go into and form an ingredient or constituent part of the product manufactured or processed for resale. That is, water sold to a packing plant would probably be taxable, while water sold to a plant manufacturing ice, or a bottling works, might not be, particularly if there were a separate meter to measure the amount of water actually being used to make up an integral part of the finished product. At variance with this idea is a recent decision in Michigan. "A Michigan Circuit Court recently held that sales of tools, materials, supplies, and power used and consumed in manufacturing tangible personal property are sales for resale and not taxable" (7). If this view should come to prevail the difference between the tax liability of materials identifiable in their products and those not so identifiable would disappear and all such sales would be exempt. This would make the tax more difficult of collection by water utilities, as it would require numerous "certificates of resale" to be executed as well as other additional book work.

Sales taxes are collectible where the taxable sales occur. As sales are concentrated in urban trading centers the per capita collections will be much less in rural districts than in the cities. In Illinois with a 2 percent tax the per capita collection for the state as a whole was $4.80 per year; in Cook County, which is nearly 98 percent urban, the per capita collection was $5.90, and in 27 counties having no city of 2,500 or more inhabitants the per capita collection was $2.18 (8).

In Iowa during the first quarter that the 2 percent tax was in effect (from April 1 to July 1, 1934) the per capita collection was $1.06, or calculated to an annual basis, $4.25. In Polk County, which is about 80 percent urban, the collection amounted to $1.76, that is, $7.04 on an annual basis (9). During the same quarter 0.62 of one

percent of the total amount of sales taxes collected in the state of Iowa as a whole was from water utilities, while in Polk County about 0.87 of one percent of the total amount collected was from water utilities. About 68 percent of the population of Polk County is served by public water supplies and probably a little less than half of the population of the state as a whole purchases their water from a utility.

Although sales taxes do make people tax conscious who previously did not pay any direct taxes, there does not seem to be much complaint against such taxes in states where they are in force. The Bulletin of the National Tax Association quotes the following from California: ". . . the sales taxes have been most gratifying. For the quarter ending June 30, 1934, the revenue from the tax has exceeded $13,000,000, indicating that the annual yield will be well in excess of $50,000,000. Our administrative costs have been kept at approximately 1.75 per cent. Public reaction toward the tax is much more favorable than it was a year ago, and a petition circulated for repeal of the Act apparently was abandoned for lack of sufficient signatures to get the matter upon the ballot for the November election" (10). Such complaints as do arise are usually in regard to the interpretation of the law rather than against the law itself.

Probably the greatest weakness of the sales tax is its regressivity. This is particularly so in its application to human necessities such as drinking water, drugs, medicines, etc. The man who earns $1,000 per year, in its expenditure pays the tax on about 60 percent of what he earns, while the man who receives between $10,000 and $25,000 per year pays the tax on about 30 percent of his income (8). For this reason alone it is not likely that the sales tax will ever become a substitute for all property taxes, or even for a major part of such taxes, but it does seem to have a very definite place in the tax system.

Many emergency measures have been evidenced during the past few years, and it would appear inevitable that for a long time water utility officials, whether representing privately or publicly owned plants, will be faced with tax problems in one form or another.

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RECORDING PHYSICAL PROPERTY DATA

By Charles Haydock

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Records of the physical property of a water works system are essential to satisfactory operation and maintenance, whether the property is publicly or privately owned.

Such records are, perhaps, of greater importance to the corporate than to the publicly owned systems, because the corporate systems not only require property records for operating purposes, the same as municipal systems do, but also for financial purposes, in that they are continually concerned with the problems of rate making, taxes, and depreciation.

There are two general classes of corporations, those organized for profit, which includes practically all corporate water systems, and those not organized for profit, chiefly water and irrigation systems organized as mutual companies, which are comparatively few in number, and can be dismissed without further consideration. In electing their particular business, water companies may assume definite obligations to the public as to the quality and quantity of their supply, and other statutory and regulatory limitations may be imposed, but no limitations can alter their status as corporations organized for profit.

It seems to be perfectly apparent that it is impossible to determine whether a business is operating profitably, unless it is accurately known on what the profit is to be earned.

The writer believes that it is of the greatest importance to all water systems to have information as to their physical plants, and, particularly as to corporate water systems, to correlate this physical data with the financial accounts of the company. In other words, the most complete fiscal records are no longer sufficient, but must be supplemented by physical records to show the plant in service and what the various units have cost.

In my opinion, the accounting records are far in advance of the physical property records. As it would be difficult to say that the

accounting records are, in general, too greatly detailed, the physical property records must be improved, if, as I believe, they are essential to the satisfactory and profitable operation of the system.

The United States Supreme Court has invariably held that rates must be based on the present value of the property devoted to the service of the public. Recently, this question has assumed increased importance, because the proponents of the prudent investment and historical cost theories have become more active. The present value theory had been accepted for many years, and it appears that, before any other basis can be used, the Supreme Court must reverse itself.

Regardless of whether rates are to be based on present value, historical cost, prudent investment, or any other method, accurate records are essential for determining depreciation for Federal Taxes; in many instances, for determining local taxes, and in some states, for the issuance of securities.

The Federal Government has, in some instances, allowed depreciation for Federal taxes in a greater amount than many commissions will allow for rate making purposes. An interesting development of this is that certain water companies which have registered their securities with the Securities and Exchange Commission, have called attention to these two depreciation charges in their registration statements.

Federal Tax depreciation is based on the value at March 1, 1913, or the original cost of the property in question to the accounting company, while for rate making purposes, the United States Supreme Court held, in the case of West vs. United Railways, decided in 1932, that depreciation must be based on present value. As far as I know, there have been few, if any, cases where a water company has secured rates which contemplate an allowance for depreciation, based on the present value of the property.

It is possible that publicly owned water systems may develop greater interest in the questions of rate making, taxes, and depreciation, as there seems to be a growing tendency to differentiate between the purely governmental functions of a municipality and those which it voluntarily assumes, such as where it engages in the business of furnishing water and other public utility services. A most interesting phase of this is the discussion of imposing taxes on publicly owned utilities and other properties that are not used in the primarily governmental activities of municipalities.

It has recently been stated that tax exempt properties in Phila-

delphia now approximate 18 percent of the total assessed values. Various public officials have called attention to the necessity of checking the increase in tax free properties.

HISTORICAL

It may be of some interest to outline certain historical developments.

In the somewhat more leisurely days of the last century, records of physical property were not common, and perhaps, were not necessary, although accurate dollar records were just as important then as they are today. A company, whether it was a private business or one of the relatively few public utilities, had its plant, which it operated, whatever it consisted of. If the business took in more money than it expended and had a cash balance at the end of the year, it was usually considered to have earned a profit, otherwise to have shown a loss.

About the turn of the century, changes began to occur.

The case which established the fair value of the property used for the convenience of the public, as the basis of determining the reasonableness of rates, was the celebrated Smythe vs. Ames case, decided in 1898, during a period of falling prices, when railroads were substantially the only public utility in which large amounts of capital were employed. As prices had been falling, present value was, in general, less than historical cost, so that the rate base was lower than if the companies had been permitted to earn a return on their historical cost.

The Public Utility Commissions, in general, were an outgrowth of the older railroad commissions, the first of which appears to have been established in 1844. In 1905, certain of these commissions were reorganized with greatly enlarged powers and charged with the duty of regulating practically all public utilities. During the next ten years, substantially all of the states passed comparable laws, regulating all or nearly all of the utilities, and prescribed uniform systems of accounting.

In certain states, regulatory commissions have jurisdiction over publicly owned utilities to the same extent as over privately owned properties. Ownership appears to make substantially no difference in the control exercised by Public Health departments over water systems.

The equally celebrated case of Knoxville vs. Knoxville Water Company, decided in 1909, established the right of a public utility to earn

in rates, in addition to operating expenses and a return on its investment, an allowance for depreciation, so that the investment might not be consumed in the public service, without recompense to the owners.

The American Water Works Association was not backwards in recognizing changing conditions, for in 1911, it collaborated with various other organizations in formulating "Uniform Accounts for Systems of Water Supply," which was published by the United States Census Bureau.

The Sixteenth, or Federal Income Tax amendment, became effective on March 1, 1913, and over night a profound change had occurred, although comparatively few seemed to have realized it at the time. Original cost and depreciation became items of the greatest importance.

Shortly afterward, the European War started, in which our Country became involved a few years later. The War occasioned excess profits, capital stock and other new taxes, which were likewise, important factors in necessitating more accurate records, both from a physical and financial viewpoint.

Existing records were, in many cases, inadequate, and older companies at a disadvantage. Newer companies had an advantage, because the period covered by the inadequate records was so much shorter.

PHYSICAL PROPERTY RECORDS DEFICIENT

One of the results of these developments is the greatly increased importance of accounting. In fact, it may well be said that, during recent years, the accountants have done a better job than the engineers, insofar as recording the facts within their particular province is concerned, because the financial transactions of a company are more accurately recorded than are its physical properties.

Practically all of the state regulatory commissions have established uniform systems of accounts, and their general policies have been to accept the property account as it appeared on the books of the company at the effective date of the uniform system of accounts, requiring the accounting companies to segregate all additions to fixed capital, in accordance with the classification.

Even though the average water company does not have an accurate record of the cost of the various units of its property installed previous to the adoption of the uniform systems of accounts, it has been

necessary to submit all available information in an effort to break down the cost of property installed before that date, in order to determine the depreciation to which the company is entitled in determining its Federal Taxes. It is also interesting to note that there does not appear to have been any action on the part of the Bureau of Internal Revenue to penalize companies unable to supply such data, and that the Engineering Division of the Bureau has cöoperated in endeavoring to break down the unsegregated cost by estimates, appraisals, and every other means available.

The recent tendency appears to be for Public Service Commissions to require better records of physical property data, and to correlate these records with the financial records of the company.

The Indiana Public Service Commission quite recently has required all utilities to file a monthly record of operations, presumably on the theory that utilities cannot be successfully and satisfactorily regulated, unless the fullest possible informotion is available.

There is, of course, a limit to all things, including the recording of physical property data. While it would be most difficult and quite expensive to build up a duplicate system of records of every utility in the offices of the various regulatory commissions to which each is subject, this is, in effect, what the Interstate Commerce Commission has done, in respect to the railroads.

Probably the best records of the physical properties of the railroads today are these same valuation records. Each time a change is made, the appropriate plan is corrected, or a new plan is made, so that there is a record of the property of the railroad in the office of the company and also of the Interstate Commerce Commission. These records represent the expenditure of enormous sums of money and have imposed heavy financial burdens on the railroads. If water companies should be compelled to prepare comparable records, they, likewise, would be subjected to heavy financial burdens.

It is believed that the necessity and desirability of recording physical property data has been established.

Recording such data divides itself into two sections; that pertaining to existing property, and that pertaining to new construction.

EXISTING PROPERTY

The task as to existing property is not an easy one, and cannot be accomplished over night. In many instances, but little more than personal recollection is available to determine what plant was constructed in a given year, and at times, it has been arbitrarily assumed

that construction, not otherwise specified, has been on the distribution system. In some instances, manufacturers and supply companies have been able to contribute valuable data as to materials purchased at various times, which would indicate the magnitude and nature of construction accomplished in a given year.

Recording such data for the future implies a more detailed accounting system than the average utility has previously had in effect. In the average case, this will go all the way back to the timekeeper on a construction job, who must allocate the time of all workmen to a particular section of the job.

FUTURE CONSTRUCTION

A work order system is a logical method to build up the necessary information for the future, but the work order must be carefully checked, and revised, if necessary, upon completion of the work. In a pending rate case, an effort was made to use a previous inventory, bringing it up to date by means of the work orders. The results obtained were not satisfactory to the Commission having jurisdiction, and an entirely new inventory is being made at considerable expense. It seems reasonable to suppose that if the work orders had been properly issued, and corrected on completion of the work, it would have been possible to bring the previous inventory up to date. It appears from this that a work order system will produce the desired results, only if it is carefully planned and followed, or corrected to show the construction actually accomplished under the work order.

The average water company cannot assume increases in costs, without impairing the return to its owners, and if more accurate records of the physical property are to be required, then in all fairness, they must be obtained at little or no expense to the company, or else the company must secure rate increases to compensate it for these additional expenses. Under present conditions, rate increases are exceedingly difficult to obtain, but the principle must not be lost sight of. As conditions more nearly approach normal, rate increases may again become possible to meet proven increased costs.

Many companies have found it necessary to prepare careful records for rate cases, and the general practise has been to maintain such records after the case has been decided. The best physical property record that I have ever seen was obtained in this manner. The company decided to prepare all of its records in a manner which would be acceptable to the United States Supreme Court. The case in question did reach that court and the water company's records were

no doubt of material benefit in obtaining the final decision, which was quite satisfactory to the company.

UNIFORM ACCOUNTS REQUIRED

The New York Public Service Commission assumed jurisdiction over water companies on July 1, 1931, and promulgated a uniform system of accounts effective January 1, 1934. The use of this system has been temporarily enjoined as certain water companies have contended that it imposed an unfair burden on them. Among other things, it requires a continuing property record, and that depreciation shall be based on the straight line, service life method. This would lead to a higher depreciation charge, and under normal conditions, water companies would be entitled to compensatory increases, but unfortunately these are not normal conditions. The system further requires that water companies write off their book value to historical cost, and I am advised that this is to be charged against earned surplus. As this entire classification has been appealed, it does not seem to be necessary to comment on this particular feature at the present time.

The Kentucky Commission has, likewise, recently established a uniform system of accounts for water companies. While I have not had the opportunity to examine this classification, I am advised that it closely follows the New York System.

Other states are also known to be reviewing their uniform methods of accounts, and it appears that the accounting system of the future will require more detailed physical property records.

Treasury Decision 4422 announced February 28, 1934, clearly points toward more detailed physical property records and a closer co-ordination with fiscal accounts.

The principle of better records of physical property, correlated to financial records, is sound and the object praiseworthy, provided it does not impose unfair burdens on the water companies, or unnecessary burdens on their consumers. The companies have only one source of funds with which to pay all of their expenses, and a return on the capital employed for the convenience of the public. That source is the revenue collected from consumers. If revenues are insufficient, service inevitably suffers. The American public has time and again proven its willingness to pay a fair price for what it needs and desires.

It is up to the water companies so to present their case that the convenience of the public is served, without imposing unfair burdens on the companies, or unnecessary burdens on their consumers.

THE COLLECTION OF NATIONAL WATER WORKS DATA

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There are today two unpardonable sins, "Indifference" and, on equal terms, "Ignorance." If we are indifferent as to what is going on around us, we shall go down into the limbo of those who did not deserve to survive. If ignorant of what our neighbors do, and are doing, our field of thinking is limited and the result is we will perish, not physically, but mentally. We should, therefore, be alert; find out what our neighbors are doing, and study their problems in comparison with ours.

It is not enough to have knowledge only of conditions within our immediate vicinity. If we are to be of assistance to our associates and valuable to the organization with which we are connected, our knowledge should cover as wide a field as possible. Our source of information and learning must be statistics compiled from data collected on a national scale. The purpose of this paper is to discuss the need for such data in the water works field. Before dealing directly with the value of such statistics, we shall review the historical background of the science so that we may have knowledge of the part it has played in the development of civilization.

HISTORY OF STATISTICS

In the early ages, knowledge of the state was the most urgent need of the period, so statistics began as the data of statecraft. Since the dawn of history, numerical data have been collected. In Judea, about 1600 B.C., we find that Moses numbered all the men capable of bearing arms and the population is estimated at 2¼ million souls (Numbers IX). The Greek scholar, Herodotus, in his second book, refers to the registration of all heads of families by the police of Egypt, in 600 B.C. There is the Greek tax census compiled by Solon, the Athenian law-giver and archon in 594 B.C., which divided the people into four classes on the basis of property owned measured in wheat. An ancient census of Athens numbered 21,000 citizens, 10,000 alien

residents, and 400,000 slaves. Rome contributed its share with periodical enumerations of population, the constitution of Servius Tullius, which distinguished six property classes, and the treatise of Hyginus, the Roman, prepared in 90 A.D., which dealt with surveys for real estate taxes.

In the middle ages, statistics were unknown other than an occasional census taken, so that the Sovereign might know the possibilities of his wartime strength and available sources of taxation. The stimulus came from the remarkably rapid transformation of mediaeval society into the form of the modern state. Monarchies longed for order and security so that commercial pursuits might flourish and financial independence be maintained. This brought about a change in the fifteenth century. The state found that the way to success was by cautious, considerate judgment, based on the best attainable information as to its own financial, military, political and commercial resources, and those of other powers.

Modern statistics had its beginning in 1746, when Gottfried Achenwald, called father of statistical science, began his lectures at Marburg. From that date to the present time, the collection and compilation of data by governments, private industries and national associations has grown rapidly and voluminously.

In our own country, the start was made in 1607, when the population of Virginia was determined. About 100 years later, we find a population census of the Carolinas. The first national census in the United States was taken in 1790, and it provided information on the movement of population, agricultural, industrial, commercial and other economic relations. A law was passed in 1866 creating a statistical bureau for commerce and shipping in the Department of the Treasury. Since 1886, the United States Bureau of Labor has issued valuable reports. Our national Banking System started the detailed series of bank statements and other data published by the Comptroller of the Currency. Prior to the establishment of the Interstate Commerce Commission, railroad transportation was a statistical blind spot. Our government to maintain a growing jurisdiction over the affairs of life has created bureaus which collect and compile national data. Likewise, we find bureaus established by the States for the recording and controlling of internal affairs.

Outside the governmental field, statistics are compiled and published by agencies and organizations engaged in nearly every phase of our national life. There are the industries, manufactories, whole-

sale and retail mercantile houses, insurance companies, trade associations, such as the Chamber of Commerce; Public Service Corporations, the largest of which are the Electric and Telephone; the academic field and the field of sports.

DEVELOPMENT OF WATER WORKS STATISTICS

The members of the American Water Works Association realize the importance of statistics and the part they play in the development of future policies. If such were not the case, we would not be able to cite the attempts which have been made in the past by this organization to compile national data in the water works field.

Having outlined general history, it will not be amiss to trace the development within our own field. In 1902, a committee on uniform statistics reported to the New England Water Works Association on the revision of the standard form which had been in use for a great number of years. Slight revisions were recommended and the type of form submitted is found in the New England Water Works Association Journal, Vol. 16, p. 54 to 58. In the same volume, beginning on page 236, comprehensive tables are published covering comparative statistics of 44 water works plants. As far back as 1886, such data were published in the journals. With few modifications, a new form has recently been published covering the consumption, pumping, purification, distribution and financial phases.

In 1908 the American Water Works Association Committee on Uniform Annual Reports approved the form adopted by the New England Water Works Association. No trace can be found that this form was submitted on a national scale, nor have the results of any tabulation made therefrom been published. As early as 1902, we find this New England Water Works Association form printed in full in the American Water Works Journal for that year (page 97). No report was made, but at least consideration must have been given to the possibilities of collecting such information prior to 1908. From 1908 to the present time, reports by committees and members, embodying comparative data on various water works subdivisions, have been published in the journals. In 1908, a tabulation of water rates for 375 cities was published, which was prepared from questionnaires submitted. Again in 1914, a comprehensive study of water rates and other information of interest to water companies was made by a committee and the results set forth. The study covered 307 cities and it required the greater part of a year to compile the neces-

sary information. Per capita consumption data in chart form covering about 150 cities were published in 1915. A filtration plant census, which was compiled by Mr. C. G. Gillespie, Director of the Sanitary Engineering Bureau of the California State Board of Health, may be found in the American Water Works Journal, Vol. 14, p. 123. The most recent compilation of information on a national scale was prepared by the personnel of the New York office of this Association and the result published in the January, 1935 issue of the Journal, page 91. The number of public water supplies by states and the communities served thereby are listed together with the population of the communities, the total population of the states, and the percent of total population served. Outside this organization, independent studies are published from time to time in various periodicals.

Perhaps the most comprehensive data were those published in the 1929 Municipal Index, covering the physical aspects of plants serving 4,300 communities. In the October, 1932 issue of the Public Works Magazine, water consumption data for 361 municipalities are given, and this has been supplemented in the September and November issues of 1934, bringing the total municipalities covered to 500. The Municipal Index again in the 1935 issue presents a tabulation of water rate schedules covering 237 cities, and this is further supplemented in the January to April issues of the American City Magazine. A survey of water rates throughout the country was recently made by the Department of Water Supply, Gas and Electricity of New York City and the report published last March. In all, the rates of 88 cities for one and two-family dwellings were compared.

COMPARISON WITH ELECTRIC INDUSTRY

The Edison Electric Institute, which serves the electric industry as this Association serves water works, prepares and publishes bulletins covering fully information dealing with the entire electric field from accidents to generator capacity. It is impossible to hope that we could prepare data to such an extent and, furthermore, it would be impracticable and without reason to attempt the collection thereof on such an immense scale. The Institute compiles information for the electric industry from about 450 reports of private and municipal plants, whose operations represent 92 percent of the entire industry. Figures for the remaining 8 percent are determined from annual reports on file with various Public Service Commissions. Compare this number of units with the 10,790 public water supplies,

as determined by the New York Office of this Association, listed in the January, 1935, Journal, page 91. Immediately, there arises a picture of the efforts which must be put forth to collect and compile information from these numerous independent water supply units. We are not unified like the electric industry and therefore our task of obtaining national data is a more complicated one.

EFFECT OF FACTS IN ECONOMICS

The field of economics illustrates in an outstanding way the importance of facts. For years the economist has been attempting to make his science a more exact and precise thing so that it might become increasingly helpful in the affairs of life. What success he has had in developing economics into a science is due, in no small measure, to the progress he is making in establishing it on a factual basis.

It is not so many years ago that economics was chiefly deductive in its process. It worked from general principles to specific conclusions. Its general principles were, for the most part, evolved out of theory and were often unsupported by facts. Now economics is increasingly inductive in its processes. It gathers facts, classifies them, interprets them, and then draws from them conclusions that are helpful because they come from facts. Clearly the trend in economics has been from theory and subjective thinking to factual data and objective appraisal, and although we cannot yet claim economics as an exact science, it nevertheless must be admitted that economics has made substantial progress in becoming increasingly effective as a tool for understanding and, in some measure, controlling the complex life in which we are living.

The senior author of this paper is a member of the Board of Managers of the Maurice & Laura Falk Foundation, an organization whose funds are being devoted to underwriting the research study of basic economic problems related to trade, industry, and finance. He has had specific occasions to see the values that can come from economic research when it is built on a factual basis. Some few years ago our Board appropriated more than $150,000 to the Brookings Institution of Washington, D. C., for a study of how the conditions of the distribution of our wealth and income affect our economic progress. Here was a problem that had long been a subject of vigorous controversy among economists. But not much progress had been made in settling the controversy because those who took part in it rested their cases, for the most part, on theoretical arguments. It was the Brook-

ings Institution that for the first time submitted the problem to objective study by making a careful gathering of the facts concerning some of the most vital matters involved in the problem. It was found that in many cases the facts controverted many of the old theories around which the controversy had been waged.

Let me give one example. The first section of the investigation dealt with a measurement of America's capacity to produce. Now our opinions and theories of the past had held that America's capacity for production was almost unlimited. But the factual study of the capacity of industry after industry showed we had no such unlimited capacity and, indeed, that during the greater part of the first three decades of the present century we could have turned out only about 20 percent more production than we actually did. Here is another example. The third section of the same investigation dealt with the processes involved in modern economic society in the formation of capital. Here again the facts controverted the old theory. In earlier days our theoretical conception of capital formation was that the creation of new productive plant and equipment depended chiefly on the availability of money which had been saved by the people and was ready for investment. The facts showed that there was clearly no definite relationship between the money saved and made available and the creation of productive facilities. Rather, the facts showed that we increase our productive facilities in response to the demand for the goods these facilities can turn out and not as a result of the mere availability of money in the investment markets. It is consumer demand, the facts showed, that stimulates the creation of productive facilities, and not mere availability of money with which to build these facilities. Here theory had to give way to fact and an entirely new point of view for understanding our economic life was made available.

Examples could be multiplied. They would show that not only has economics made its best progress since it turned its attention to a factual basis, but also that this attention to facts has thrown into the discard many of the theories we once worshipped, and has identified clearly those theories which can be given credence because they are in accord with the facts.

NEED OF STATISTICS

Just as the science of economics needs a factual background to help meet the problems of tomorrow, so we must be prepared with our

facts and data to apply these new principles to our profession. In water works practice, those problems will continue to arise. For the design and development of new plants, there is a real need for knowledge of domestic, industrial and municipal water consumption in like communities. Municipal authorities from studies of such information can plan adequate supplies for their communities. By knowing the consumption in a like community in comparison with their own and the population growths of the respective communities, planning for the future can go forward on a logical and far-sighted basis. By comparison of storage capacities, together with data relative to water shortages many trials and tribulations can be avoided in the future.

Operating statistics relative to costs of pumping and costs of purification will fill a much needed want. The plant manager or the commissioner of water seeing that his costs of pumping and purification are much higher than in similar communities having comparative plants, immediately knows that something is wrong. We all like to make as good a record as possible, and by knowledge of the other man's costs our incentive to begin investigations for betterment is excited to the highest degree.

Comparative data on physical aspects of the plant, such as miles of mains, number of fire hydrants, services, meters, etc., are necessary for comparing maintenance costs, adequate fire protection, the cost of reading meters, etc. If we know that our cost of reading meters is excessive in comparison with that of a like system perhaps by adopting the other man's method we can make a real and lasting improvement. Likewise comparative maintenance costs per mile of main may show us where our methods are lax.

To know the total number of employees in similar plants would enable the water commissioner or plant manager to know whether or not his plant is overmanned. Therefore, information relative to the total number of employees engaged in the various units of water works plants would be valuable.

There is another side of the picture and this is that existing plants should be able and ready to refute charges and attacks made upon them in this period of agitation against privately operated utilities by the public and the lawmakers and against public plants by taxpayers leagues. Such innuendos as are put forth against rates, operating expenses and financing, cannot logically and forcefully be combated unless we are familiar with operating conditions throughout the country.

As an example, we cite an editorial that appeared in the local paper of a small New York municipality, just one day after the publication of the recent survey of water rates and charges which was made by the City of New York. This editorial suggested an investigation into the water rates because they were higher than those in a neighboring city. We do not know whether or not these rates were reasonable, but one system was on a flat rate basis, while the other was 100 percent metered, so the cost of water per consumer should not necessarily be the same. It is obviously unfair to compare water rates for domestic, fire and industrial consumption unless all cost accounts are carefully considered. Numerous examples affecting the cost of water served may be cited, such as taxes paid by private plants; assessment of frontage taxes by certain municipalities; pumping and purification expenses and maintenance. Financial and operating cost statistics cannot be used blindly in comparing the cost of water in one plant against that in another, but the general public does not think of this and direct comparisons of rates without full explanation as to the types of systems do irreparable damage. Information as to cost of water, types of systems, rates and finances should be collected and developed by this organization so that we will be ready at all times to assist in every way possible our members in their dealings with the public.

METHODS OF COLLECTION

On a large scale the only practical method of collecting information is by the submission of a questionnaire. The success that may be attained by this means is dependent upon the type and number of questions asked. The Public Works Magazine found that in compiling water consumption data only 361 of the 654 questionnaires received could be used. The others were not sufficiently complete to be of value. New York City could use but 87 replies out of 126 cities canvassed in the development of their comparative rate study.

Other sources are lacking in essential information and there is no one source existing today that is reliable. In order for the New York Office of this Association to prepare a list of water plants in the United States, it was necessary for them to review and use independent State Board of Health reports, Water Works Journals, Department of Interior Water Supply papers, and even maps. For some states, conflicting data were found in the various sources of information.

Only recently the Basic Data Committee of this organization was

discharged upon the recommendation of its chairman. The Committee reported that after extensive study, it was found impractical to prepare national data from existing state publications. There was great variation in the methods employed by the states in compiling data and many of them did not issue information regarding water plants.

TYPE OF DATA WHICH SHOULD BE COLLECTED

Comprehensive data to be of value should be as concise as possible, and no attempt should be made to obtain immaterial items which have no national interest. By the submission of a questionnaire dealing only with pertinent facts, we should after education of those in charge of water systems secure real results. Information of the following type should be collected:

1. Name of community served, population, source of supply, gravity or pumping system, filtered or unfiltered water.
2. Water consumption, dealing with average and maximum daily use; annual domestic, industrial and municipal use.
3. Fixed capital installed, bonded debt, capital stock, surplus, operating expenses, taxes and assessments, domestic, industrial and fire service use and revenues.
4. Physical aspects dealing with miles of mains, number of services, meters, fire hydrants, etc.
5. Personnel and organization set-up.

CONCLUSION

The problem before us in attempting to collect data on a national scale is two-fold,—first, there is the problem of educating those in charge of water systems as to the necessity and need of furnishing complete and authoritative data; secondly, there is the financial aspect, dealing with the cost of compiling and publishing the data after receiving it. The latter can be solved, but it is not so easy to solve the former. Many operating men lay aside the appeals for information, not through carelessness nor neglect, but because it is something which is not pressing and, therefore, quickly forgotten, and also many do not thoroughly understand just what is wanted when certain information is asked for.

We feel that an educational campaign should be extensively carried out by the Accounting and Finance Division to acquaint the operating men with the value of statistics in the field and to secure uniformity in the information furnished.

Studies should be made to develop a standard form with which to secure the needed data. Afterwards the collection of the information should be started on a small scale basis in certain selected areas. With such areas contributing data, others will gradually fall in line. It is not a matter of a year's work; it will take perhaps five years before we have close to one hundred percent coöperation. This fact should not be discouraging, however, for we believe that at the end of such a period a much needed want will be filled. Water works officials will then be enriched in knowledge which will enable them to carry on on an enlightened basis.

Constantly educating, compiling data and preparing it for publication we believe to be the work of an engineering statistician. Therefore, we should seriously consider adding a man of such caliber to the American Water Works Association staff whose sole aim and purpose shall be the development of water works statistics.

National water works statistics are badly needed, but it would be useless to attempt collection at the present time. First, let us educate; then let us collect our data. We are sure the needed information will be given much more readily if all understand the necessity thereof and the good that may be obtained from comparative data; and also it will prove to be of real value in determining future policies and in our public relationships.

RELATION OF ENGINEERING AND ACCOUNTING TO THE ITEM OF DEPRECIATION FOR RATEMAKING AND FOR TAXES

By E. E. Bankson

(Consulting Engineer, The Chester Engineers, Pittsburgh, Pa.)

Your attention is here invited towards the subject of depreciation by reason of the many recent critical statements of the U. S. Supreme Court directed towards certain excessive accumulations of depreciation reserve.

For the sake of a target, let us presume that both engineers and accountants, along with management, had a finger in the pie that met with disfavor in the eyes of the Court.

When I contemplate the multiplicity of ideas and practices relating to depreciation reserve, and accrued depreciation, I am surprised that the Courts have not heretofore indicated more definite guidance in the matter. But, finally, it did require the attention of nine men in Washington to show us the beginning and direction towards an agreement.

Many railroads and some other business men deny the propriety of making any annual depreciation charge, the accountants may possibly tell you to compute it on original cost, and we can quote the claim of at least certain engineers that depreciation should be computed upon the replacement cost at the time of the future retirement.

Or again, in contrast to the railway idea of ignoring the charge the accountant will probably argue for straight line depreciation and at least many engineers will advocate the sinking fund method.

May I inquire, however, as to the purpose of the particular annual charge which may be represented in the mind of each of these advocates.

The railway plan is very well suited to certain types of property where the land and roadbed, representing a large portion of the entire value, may even show appreciation and where the annual replacements quite uniformly represent a fair charge for annual depreciation. The annual depreciation allowance, therefore, will be represented by the item of fixed capital replacements during the year; and thereby properly recorded as an operating or production cost.

The straight line plan is well suited to property possessing long life in its several elements, where the company may desire free use of its depreciation reserve, for plant extension or other purposes, and where the management is in need of the most simple process for computation of the annual charge to depreciation reserve. It is also well adapted to plant items of very short life characteristics.

The sinking fund method is applicable to property of long life characteristics, where the management does not desire any hidden advantage of additional benefit, by the free use of money from its depreciation reserve, and where it does desire, on the other hand, to preserve and indicate a higher value of depreciable assets during the years than that which would be indicated by the records from the straight line method.

Depreciation for ratemaking has no necessary relation to depreciation for federal income tax. In the opinion of your speaker, it is perfectly correct and proper if the figure is found to differ in the two cases; although the practical and human tendencies may possibly cause the gradual convergence of these two fundamentals toward one common viewpoint.

The allowance for annual depreciation in ratemaking is for the purpose of restoring the amount of capital consumed in service during the year; in order that the integrity of the investment may be preserved, and in order that the property be protected from confiscation.

The item of annual depreciation for taxation serves merely as one element of an arbitrary plan which has been formulated for the purpose of distributing the tax burden to the citizens, selected in a specific way; which plan now appears to some as subjecting property to confiscation.

This item in ratemaking seems to owe its very existence to the constitution as upheld by our highest judiciary, whereas for federal income reports it appears to represent a legislative-administrative creation, in the taxation merry-go-round.

Thus I am compelled to view these two purposes as reflecting from fundamentally different antecedents; which, in turn, would appear to justify sharp differences in practice or in law, as between these two purposes.

THE LAW

The U. S. Supreme Court has given us the law, in these matters, which may be found as follows:

In the Baltimore Ry. Case of 1927–1930, for purposes of ratemaking, the Court pronounced the law in these words:

"The allowance for annual depreciation made by the Commission was based upon cost. The Court of Appeals held that this was erroneous and that it should have been based upon present value. *The Court's view of the matter was plainly right.*" . . . . "It is the settled rule of this Court that the *rate base* is *present value*, and it would be wholly illogical to adopt a different rule for depreciation." . . . . "We repeat, the purpose of permitting a depreciation charge is to *compensate* the utility *for property consumed* in service."

On the other hand, the 1934 Federal Income Tax law is entitled "An Act, to provide Revenue, *equalize taxation*, and for other purposes" and, by Section 113 (a), it is indicated that the basis of property value for determination of gain or loss—"shall be the cost of such property" except for bequests, etc., etc. Income Tax Regulations No. 86, Art. 23 (1)–4, says that "The capital sum to be replaced by depreciation allowance is the cost—or other basis—of the property in respect of which the allowance is made (See Sections 113 (a) and 114)."

The *cost basis*, for income tax purposes, was approved by the U. S. Supreme Court, in 1927; which was prior to its depreciation pronouncement in the Baltimore Ry. Case. In that case, of United States vs. Ludey (1927) (274 U. S. 295, 71 L. ed. 1054, 47 Sup. Ct. Rep. 608), for income tax purposes, the Court said:

"The amount of allowance for depreciation is the sum which should be set aside for the taxable year, in order that, at the end of the useful life of the plant in the business, the aggregate of the sums set aside, plus salvage, will suffice to provide an amount equal to the *original cost*."

The meaning of the foregoing reference to *present value* is partly indicated in the Indianapolis Water Co. decision of 1926, (272, U. S. 400, and P. U. R. 1927 A, 15) by the words of the Supreme Court that "*Reproduction Cost* Estimates have *great weight*" in the determination of fair value. In the concurring opinion of Justice Butler, however, relating to the Illinois Bell Telephone Case of 1934 (54 S. Ct. 658), we receive the inside information that "(the straight line method on *cost* less salvage) is not in harmony with the principle of our decision in United Railways Case (Baltimore) which required *replacement* cost to be taken as the basis of calculation (280 U. S. 234 and 50 S. Ct. 123)." Thus the expression "Present Value" means "Replacement Cost."

To summarize, therefore, we have pronouncements by the Supreme Court that, for ratemaking purposes, the annual depreciation be based on *present value* (replacement cost) and that for Income Taxes it be based on *Original Cost.*

If there be those who have not followed the indication of evidence which have risen to the surface out of all of this scramble, you might properly raise the question of "why all the holler;" but, for the benefit of that person, permit me to mention some very vivid indications of criticism, by the U. S. Supreme Court:—as follows.

Depreciation of gas wells in the Dayton Power and Light Case (54 S. Ct. 647 of 1934) offers a reminder of an early prophecy, by the writer that the probable life of certain gas wells would not exceed eight years and the depreciation for the wells, with connecting lines, was based on such a period. Fifteen years have now elapsed, and most of that system is still active.

In this Dayton Case the Company labeled as excessive the accrued depreciation by the Commission at 58.1 per cent for gas wells and equipment; although benefiting in the rate base by a corresponding annual depreciation allowance.

What I wanted to quote from the Dayton Case, however, relates to the effect and impressions upon the Commissions and Courts by the use of inconsistent figures and claims, together with the ultimate results from an accumulation of exaggerated practice, as indicated by these words of the U. S. Supreme Court:

"In a statement put in evidence by the appellant, the rate of return under the new schedule is said to be 1.28% of the fair value of the property. . . . . So modest a rate suggests an inflation of the base on which the rate has been computed. It is a strain on credulity to argue that the appellant . . . . was satisfied with one (schedule) productive of so meager a return. . . . . The argument proves too much."

From the Court opinion of 1933, in the Los Angeles Gas and Electric Case, we find a depreciation reserve of $17,000,000 on a $66-000,000 value (before depreciation) in the face of the company claim for *actual* accrued depreciation at $3,470,000, and annual depreciation at $2,344,000. Please notice that the actual reserve is five times the company claim for actual accrued depreciation, and a company claim of accrued at only one and a half times the company claim for annual depreciation.

In the Illinois Bell Telephone opinion of 1934, there was indicated a depreciation reserve of $48,000,000 on a Book Cost of $177,000,000;

as compared to a company claim for actual accrued depreciation at $16,000,000. The company, therefore, took the position that its depreciation reserve was three times its fair accrued depreciation.

INCONSISTENCIES IN DEPRECIATION PRACTICE

Will you now permit a few questions regarding these inconsistencies, of such astounding proportions? Had the accountants created too heavy a reserve, or had the engineers indicated too little for accrued depreciation; had the accountants been too zealous in building operating costs, as support for higher rates, or had the engineers been too zealous to preserve higher plant values; was this reserve overbuilt in a desire towards income tax reductions; and where did the management expect to arrive as between two such widely divergent figures which are intended to represent the same thing, as nearly as possible?

If such evidence, as the foregoing, is presented to the Commissions and the Courts, what about all the other instances of practice not uncovered to the public gaze; what of the responsibility for permitting such inconsistencies; have the engineers and the accountants failed this responsible trust, by reason of a temptation to the opportunist?

In my humble opinion, the majority of engineers and accountants have failed of proper cooperation in this connection; and may have failed to show the adequate mental or moral stature required for proper guidance in this matter. The water works profession should now take adequate heed before the records of account, for this item, show results too far afield from the true facts and conditions.

By a lack of mental and moral stature, I am thinking of the apathy towards sufficient detail knowledge; of the willingness to think as opportunists; and finally that we have permitted management to view this annual allowance in some way different than for its true purpose. We continue to rely on some convenient percentage without sufficient attempt to discover the real and specific needs, and we have generally failed to preserve, or approach, any proper relation between the depreciation reserve and the actual accrued depreciation.

For ratemaking purposes, it is the conviction of the writer that dangerous disparity, between plant condition and the reserve, could never exist if depreciation reserve were recorded, on a reasonable basis, against each plant unit—and against ordinary distribution system by period groups. In this way, the annual allowance on any item would cease, as soon as the reserve had reached its proper total,

and such a result would automatically serve as a sufficient balance-wheel against the reserve account; so that the total reserve could never depart greatly from the fair and proper requirements of the specific case.

Related to income tax, it is again my opinion that the depreciation computed for water works property should be comparable to the depreciation for all other kinds of various property. If other industry is accorded a high depreciation, then water works should be treated in a similar fashion. If other industry is limited to a low rate of depreciation, then water works should also be so limited. "Equalization of Taxes" is the primary requirement; although the Federal Revenue Act of 1934 becomes very precise in its depreciation requirements.

For depreciation deductions on income tax returns, the Federal Revenue Act of 1934 and treasury decision No. 4422 was analyzed for us last year at the New York Convention by Mr. Louis D. Blum. From that presentation, it is clear that close cooperation is required between engineering and accounting for income tax returns. In fact, the discussion of that paper, by Mr. Schwartz, indicates that "Present conditions call for closer cooperation than ever between the accounting officer, the engineering executive, and those who prepare the tax return."

The compelling feature of that revenue act, regarding depreciation, may be partially abstracted from Mr. Blum's presentation, as follows:

> "The burden of proof will rest upon the taxpayer to sustain the deduction claim." . . . .
>
> "The taxpayer is required to prepare all schedules and other data deemed necessary in proving the correctness of the depreciation deduction."

Suffice to here remark that the detail requirements involve information of engineering nature, as well as cost data, so that the taxpayer may well avoid trying to eat his cake and also keep it.

In conclusion, may I commend a resolve to treat this item of depreciation as if we were master of the principles involved; instead of winking at doubtful methods and practices which are leading to disastrous results in many cases. The feeling that time itself will solve the problem, without effort on our part, is a dangerous guide and results could be only disappointing. Depreciation Reserve should be recorded only under a definite plan as to the ultimate and unavoidable results.

Attached will be found a more detailed citation and discussion

relating to this subject of depreciation; as partially reflecting support for the foregoing discussion.

DETAILED CITATION AND DISCUSSION

In the recent opinion of the U. S. Supreme Court for the Illinois Bell Telephone Case (54 S. Ct.-664), Chief Justice Hughes stated that:

"Broadly speaking, depreciation is the loss (in service value), not restored by current maintenance, which (loss) is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence. Annual depreciation is the loss which takes place in the year."

Chief Justice Hughes also stated that:

"Depreciation is defined as the expense occasioned by the using up of physical property employed as fixed capital; current maintenance, as the expense occasioned in keeping the physical property in the condition required for continued use during its service life. But it is evident that the distinction is a difficult one to observe in practice with scientific precision, and that outlays for maintenance charged to current expenses may involve many substitutions of new for old parts which tend to keep down the accrued depreciation."

For the Indianapolis Water Company Case, the U. S. Supreme Court said, that evidence of observed depreciation presented by competent witnesses was to be preferred to mere calculations based on averages and assumed probabilities.

In the Clark's Ferry Bridge Case, the Pennsylvania Superior Court in effect said, with respect to depreciation, that inspection and examination of a structure should not be merely an outward or superficial operation, but should take into consideration the internal changes.

For the Chambersburg Gas Case our Pennsylvania Commission clearly indicated that:

"The requirement of law is that depreciation shall be based on a thorough study of the physical property and its present and future usefulness. Neither a physical examination nor a mathematical calculation, based on assumed useful life, meets this requirement alone."

And thus we may assume that the Pennsylvania Commission considers that computation combined with sound judgment applied to inspection is required to reach a proper conclusion of observed depreciation.

In all recent decisions applying, or applicable, to Pennsylvania

practice, it is unquestionably clear that annual allowance to depreciation reserve must bear a proper relation to accrued depreciation; and any attempt at evidence to the contrary would constitute a weakness of position, rather than strength.

In this latter connection, it is the opinion of your speaker that the Pennsylvania Commission looks upon the 4 percent sinking fund method, of depreciation computation, as the vehicle by which depreciation observation and judgment of experience can best be correlated, through computation, to the aforesaid relationship.

A failure of adherence by certain utilities to this principle of depreciation relationship, together with a continued excessive mounting of depreciation reserve, in those cases, beyond any possibility of need, has precipitated certain recent court decisions to a definite guidance for us in this connection. Existing facts of record correlated with results of observation and sound judgment attain a place of ever increasing importance, in these decisions; as contrasted to arbitrary percentages or to personal theories unsupported by existing facts.

And finally, from recent cases before the U. S. Supreme Court, it is evident that excessive charges to depreciation reserve will eventually constitute adverse evidence, although it is a presumption of the writer that such excess accumulations are highly improbable in water works practice.

Chambersburg Gas Case—Nov. 15, 1932

The opinion of the Pennsylvania Commission with respect to depreciation is definitely stated in its decision of November 15, 1932, for the Chambersburg Gas Case (11 Pa. P. S. C. 583) to the effect that:

> "The requirement of law is that depreciation shall be based on a thorough study of the physical property and its present and future usefulness. Neither a physical examination nor a mathematical calculation based on assumed useful life meets this requirement alone."

In that case, the depreciation of respondent's engineer was clearly stated to cover only the visible results of wear and tear and made no allowance for obsolescence; whereas the depreciation by complainant's engineer was claimed as the result of his examination of visible property, together with the mathematically computed depreciation on the age life method and sinking fund formula.

The respondent also contended for the straight line method of computation, and had further insisted that there was no relation

between the amount of the annual reserve and the accrued depreciation to be used in determining the rate base. In this latter connection, the Commission opinion admitted that:

"The annual charge to reserve for depreciation . . . . is not necessarily exactly equal to the concurrent actual depreciation. It is none less the fact that both figures are judgment figures based on a full consideration of identically the same elements. . . . . Consequently, while there is no direct mathematical ratio by which one may be automatically related to the other, yet there is a reasonable relationship between the rate at which depreciation has been occurring and the amounts of reserve which future depreciation will necessitate."

The claim of the company for accrued depreciation had been less than $38,000 as compared to a claim for annual allowance at almost $13,000 per year; or an accrued depreciation of less than three years accumulation at the requested rate.

Scranton-Springbrook Case—June 19, 1934

In the opinion of the Commission for the Scranton-Springbrook Case, under date of June 19, 1934, the foregoing definition of the law was reiterated, together with the words of the court in the Clarks Ferry Bridge Case (108 Pa. Superior Ct. 49, at Page 75) to the effect that:

"The inspection and examination of a structure, which is undergoing gradual constant change and disintegration, should not be merely an outward or superficial observation, but should take into consideration the internal changes which engineers agree are taking place in such a structure. Such an examination is to be preferred to mere calculations based on average and assumed probabilities; McArdle v. Indianapolis Water Company, 272 U. S. 398,416."

In this case the respondent engineers have followed the so-called observed depreciation method as compared to the life age computation on the 4 percent sinking fund method by the complainants (as based on the adjusted lives and ages which had been furnished by Mr. Harrop of the respondent).

Because of citation by the court regarding the original decision of the Commission:

"That accrued depreciation for several items was even less than the amounts conceded by respondent."

it became necessary in this last opinion of the Commission to fortify its original position by pointing out that age had not been an element effecting the respondent's witnesses' judgments on observed depreciation.

"Mr. Harrop admits he did not consider the age of the structures and in Mr. Ehler's remarks, age was not given any thought and he did not think it had much to do with it.

The Commission further stated that:

"Those basic considerations used by respondent's witnesses in stating the amount of accrued depreciation show that the witnesses gave no weight or consideration to those internal changes, which engineers agree are taking place in such structures, neither as relating to the physical condition of the structure under consideration, nor the probability of a continued usefulness as a service unit. This latter point is brought out by the fact that Covey Reservoir, referred to above, as having a total depreciation of $400, together with Trout and Monument Intakes which had been figured similarly, as admitted by the respondent, have reached the point where they are no longer used and useful in rendering public service."

Also as an item of inconsistency, the Commission further cites that:

"Nesbitt Reservoir, on which the respondent said an observed depreciation of $2,200 is shown of record to be twenty-six years old . . . . and expected life of one hundred years . . . . resulting in an accrual of $51,314, calculated on 4% sinking fund basis and an annual depreciation of $3,247."

As against the foregoing, respondent's witness, Harrop, proposed an average depreciation allowance of three-quarters of one percent per year for the entire property, or stated by the Commission as $11,454 for Nesbitt Reservoir, as totally unrelated to his judgment on observed depreciation and directed towards this position the Commission then said:

"However, the difference resulting from the determination of a proper allowance for each individual structure would not be sufficient to account for the disparity between an accrued depreciation of $2,200 on a structure twenty-six years old and the proposal for an annual allowance approaching $11,454; and we are persuaded that the estimates of observed depreciation should be excluded, as they are only estimates of the amount of deferred maintenance, or current maintenance uncompleted at the time of the investigation. . . . ."

"Because of the character of this record, the Commission has followed the age-life method of determination and computed allowances for depreciation on the 4% sinking fund basis."

In connection with this latter position of the Commission, we should quote from the opinion of the Superior Court, in remitting the record to the Commission, regarding annual allowance for depreciation, to the effect that:

"Whatever method may have been used, it should also appear that the allowance for annual depreciation bears a proper relation to the accrued."

In connection with the foregoing indication of the law in Pennsylvania, relating to depreciation, we are favored with certain recent decisions of the United States Supreme Court wherein is indicated the disparity between the accumulated depreciation reserves and the claims for accrued depreciation, as follows:

(1) The Los Angeles Gas & Electric Case;—with the opinion written on or about May 8, 1933 by Mr. Chief Justice Hughes (53 S.CT.-637) affirming the Railway Commission and the Federal District Court.

Depreciation reserve had been built up through the years to the amount of almost $17,000,000, on a fair value of less than $66,000,000 (undepreciated), where an accrued depreciation was claimed by the company at $3,470,000, and an annual allowance at $2,344,000 (all in round numbers). In its decision the Commission had fixed the accrued depreciation at $7,650,000 and the annual at $1,072,000.

The District Court had noted the inconsistency of these claims by the company and had said that:

"The allowance for depreciation annuities which have been made prior to the rate hearing under review were excessive and were not capable of definite ascertainment, and that it had not been shown that the Commission had not exercised a reasonable judgment."

The Supreme Court upheld the Commission and the District Court by concluding that:

"No ground appears for challenging the finding of the Commission, made upon inspection and appraisal, that the accrued depreciation of the property amounted to $7,650,000." (53 S.CT.-646).

and also regarding the depreciation annuity of $1,072,000, the court said:

"But it is not clearly shown that what the Commission allowed will not be adequate protection for the purpose in view." (53 S.CT.-649).

(2) The Dayton Power & Light Company Case;—With the Opinion written on or about April 30, 1934, by Mr. Justice Cardoza (54 S.CT.-647) affirming the Commission and the Ohio Suppreme Court.

For depreciation reserve, the annual reports of the company to the Utility Commission carried an item of 2 percent on distribution system; whereas the company claim in the rate case amounted to 4 percent for the item of distribution system The rate of 2 percent was not disturbed and the entire question of depreciation, amortization, and depletion was balanced against accrued depreciation. Among other observations the Court stated that:

"The truth seems to be, as was stated by a witness for the appellant, that the percentage of depletion appropriated for gas fields is the wildest sort of guess. . . . . We think the allowance for depletion instead of being too small, is so manifestly excessive as to supply a margin for the correction of other contested items that may approach the border line."

this depletion having been figured on a remaining life of only three years and two months.

And finally, the Court said:

"The appellant though claiming that the percentage of the depreciation is excessive, has had a benefit more than equivalent to any injury, in the enhancement, for the allowance of amortization and depletion."

(3) The Illinois Bell Telephone Case; With the Opinion written on or about April 30, 1934, by Chief Justice Hughes (54 S.CT.-658) reversing the Federal District Court and affirming the order of the Commission to file a reduced rate schedule equivalent to somewhat over $1,000,000 per year.

The Company claimed accrued depreciation at under $16,000,000 whereas the record depreciation reserve exceeded $48,000,000, at 1931; against a book cost of over $177,000,000 (accumulating from a book cost of $95,000,000 in 1923).

The Opinion of the Commission concluded that the depreciation reserve had been built up by annual additions that were in *excess* of the amounts required.

After the company had provided volumes of tabulations and statistics, the Supreme Court found the company in a healthy condition, and its business profitable, and made the statement that:

"In the light of the evidence as to the expenditures for current maintenance, and the proven condition of the property—in the face of the disparity between the actual extent of depreciation, as ascertained according to the comprehensive standards used by the company's witnesses, and the amount of the depreciation reserve—it cannot be said that the company has established that the reserve merely represents the consumption of capital in the service rendered. Rather, it appears that the depreciation reserve, to a large extent, represents provision for capital additions, over and above the amount re-

quired to cover capital consumption. This excess in the balance of the reserve amount has been built up by excessive annual allowances for depreciation charge to operating expenses. . . . .

The company has had abundant opportunity to establish its contentions. In seeking to do so, the company has submitted elaborate estimates and computations, but these have overshot the mark. Proving too much, they failed of the intended effect. It is not the function of the court to attempt to construct out of this voluminous record independent calculations to invalidate the challenged rates. It is enough that the rates have been established by competent authority, and that their invalidity has not been satisfactorily proved."

After pointing out the abundant evidence of the healthy condition of the company, the growth in plant value and fixed capital, together with the extraordinary growth in depreciation reserve, the court was prompted to state that:

"This actual experience of the company is more convincing than tabulations of estimates. . . . . Elaborate calculations which are at war with realities are of no avail. The glaring incongruity between the effect of the findings below, as to the amounts of return that must be available in order to avoid confiscation, and the actual results of the company's business, makes it impossible to accept these findings as a basis of decision."

In the concurring opinion of Justice Butler, it is pointed out that the principle followed by the company for the ascertainment of amounts for annual depreciation was:

"The straight line method calculated on cost less salvage."

and then proceeds to point out that:

"This is not in harmony with the principle of our decision in United Railways (Baltimore) Case which required replacement cost to be taken as the basis of calculation (280 U. S. 234 and 50 S.CT. 123)."

"From the foregoing, it justly may be inferred that charges made according to the principle followed by the company creates reserves much in excess of what is needed for maintenance. The balances carried by the company include large amounts that never can be used for the purposes for which the reserve was created. In the long run, the amounts thus necessarily taken from revenue will rate about one-half the total cost of all depreciable parts of the plants. *The only ligitimate purpose of the reserve is to equalize expenses for maintenance so as to take from the revenue earned in each year its fair share of the burden.* To the extent that the annual charges include amounts that will not be required for that purpose, the account misrepresents the cost of service. . . . . Taken as a whole, the plant must be deemed to be permanent. It never was intended to be new in all parts. It would be impossible to make it so."

(4) The Columbia Gas & Fuel Case;—With the Opinion written on or about May 21, 1934 by Mr. Justice Cardoza (54 S.CT.-764) reversing the Ohio Supreme Court in favor of the Commission's action with respect to amortization, depletion, etc.

In the Commission decision, an allowance for depletion, etc., had been made the same as in the Dayton Case, but upon appeal by the city to the Supreme Court of Ohio, the item thus allowed was excluded altogether. In the words of the United States Supreme Court:

"It (the Ohio Court) put its judgment upon the ground that the statute of Ohio defining the powers of the Commission and the method of appraisal makes no provision for depletion, ... and that the statute, nothing else, gives the applicable rule. We may assume in submission to the holding of that court that the amortization allowance must be rejected if the ratemaking process is to conform to the rule prescribed by statute, irrespective of any other. That assumption being made the conclusion does not follow that the statutory procedure may set at naught restrictions imposed upon the States, and upon all their government organs by the Constitution of the nation. . . . .

To withhold from a public utility the privilege of including a depletion allowance among its operating expenses, ... is to take its property away from it without due process of law, at least where the waste is inevitable and rapid. . . . . Plainly, the State must either surrender the power to limit the return or else concede to the business a compensating privilege to preserve its capital intact."

Finally, the opinion of the court is found in the words that:

"We hold that a fair price for gas delivered at the gateway includes a reasonable allowance for the depletion of the operated gas fields, and the concomitant depreciation of the wells and their equipment. . . . . The (lower) court will have to say in the light of all the circumstances whether the amount be allowed shall be the same as that fixed by the Commission, or something less, or something greater."

DISCUSSION

LOUIS D. BLUM, *New York, N. Y.:* Mr. Bankson's paper very ably points out the *disparity in depreciation allowances as determined for rate making and Federal Income Tax purposes.* My experience insofar as depreciation is concerned has been solely from the accounting and tax viewpoint, but I have had ample opportunity to absorb some of the engineering technique in computing depreciation for income tax purposes. It is sometimes quite difficult to explain satisfactorily to one not familiar with the subject the reasons for computing depreciation by several different methods each of which is dependent on the purpose to be served.

Although the established rule for rate valuations is the present

value there appears to be a movement afoot at the present time by some of the regulatory bodies to give more consideration to the actual cost of property in determining rates. The Public Service Commission of the State of New York now requires utility companies to prepare a detailed inventory of their plants showing the cost of the various units in detail, the date of acquisition or installation and the depreciation reserve computed on a straight line basis. This method is comparable with the procedure prescribed for ascertaining depreciation for Federal Income Tax purposes.

Mr. Bankson's reference to the several methods for computing depreciation allowances reminds me of some of the questions often raised when depreciation rates allowed by Commissions are compared with rates used for other purposes. In this connection it should be observed that some Commissions recommend the sinking fund basis whereas the Treasury Department recognizes the straight line method. It should be noted that a 1 percent annual installment to a sinking fund at 4 percent interest will accumulate to 100 percent in 40 years or, such a sinking fund rate translated into a straight line rate is 2½ percent per annum. From my observations I have learned that most utilities which set up depreciation on a sinking fund basis do not properly follow out the method from an accounting standpoint as I understand it. When the sinking fund method is used funds may actually be segregated and invested. The income account should be charged with an amount equal to the annual installment to the sinking fund plus the theoretical income earned on the fund and depreciation reserve credited. Where an actual fund is established the income thereon should be shown as an earning. As a matter of practice funds are not actually segregated, but usually are reinvested in plant; in such cases no entry is usually made for the theoretical interest. Under this method the utility is relieved from borrowing for new construction to the extent of the sinking fund used for that purpose, thereby saving interest which results in a greater net income. Under such circumstances the income account should be charged with the theoretical interest which would have been earned had the sinking fund actually been established.

In a great many indentures issued by water companies it is provided that 9 percent of the gross revenue be set aside annually for depreciation, maintenance, repairs, etc., and in some of the instruments which I have examined extensions, additions, betterments and renewals are also included in such provision. In following out the provisions of the indentures depreciation and maintenance are the

only factors which are usually taken into consideration. Under this method the depreciation is computed by deducting the maintenance from 9 percent of the gross revenue. In my opinion, this method represents the wildest kind of a guess and in cases where the maintenance exceeds 9 percent of the gross it is reduced by applying a credit for depreciation to bring the maintenance down to the specified 9 percent. In other words, such procedure would indicate a profit arising from depreciation. This variety of accounting may serve the purpose of showing high earnings to prospective investors, but from a conservative engineering and accounting standpoint it can hardly be recommended.

Mr. Bankson suggests that the depreciation reserve be built up against plant units and against distribution system by period groups. As a practical matter I agree with his views and I might say that the period group procedure has been used by us in settling depreciation questions with the Internal Revenue Department. In recording depreciation for a continuous structure such as distribution mains nothing could be gained by segregating the costs of all installations and accumulating separate depreciation reserves against them. In making entries for retirements or abandonments it would be necessary to go beyond the books of account in order to ascertain the actual cost of the property so that correct values may be written out of the plant account.

With reference to the recording of depreciation I wish to direct your attention to Article 23(1)–9 of Regulations 86 promulgated under the Revenue Act of 1934 from which the following is quoted:

"In order that the verification of depreciation allowances claimed by a taxpayer may be facilitated, depreciation shall be recorded on the taxpayer's books, the amount measuring a reasonable allowance for depreciation either being deducted directly from the book value of the assets or preferably credited to a depreciation reserve account, which should be reflected in the annual balance sheet. . . . . If a taxpayer does not desire to have his regular books of account show all of the factors entering into the computation of depreciation allowances, such factors shall be recorded in a permanent auxiliary record which shall be kept with and reconciled with the regular books of account."

Insofar as cooperation between the engineer and the accountant is concerned I am in full accord with Mr. Bankson's views, but it should be borne in mind that it will be *impossible* to bring *the computation of depreciation allowances for all purposes into agreement* until all of the factors entering into such computation, regardless of the purpose to be served, are harmonized.

SHOULD MUNICIPAL PLANTS BE REGULATED BY UTILITY COMMISSIONS AND BE SUBJECT TO TAXATION?

By Joseph A. Beck

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The Supreme Court of Pennsylvania (the highest appellate court of that State) handed down on March 27, 1933, its decision in the case of Shirk vs. City of Lancaster. The case is reported in 313 Pa. State Reports 159.

Generally speaking, by this decision it became established law in Pennsylvania that the rates of municipal plants were to be tested as to their reasonableness by substantially the same standards as are applied in testing the rates of private water companies. I was of counsel in this case, which is probably the reason why I have been asked to address you on the subject assigned.

It does not seem to me that it is essential in the consideration of this matter whether the regulation of municipal plants be by the state utility commissions, provided that the regulation be similar to that administered by such commissions. For instance, in Pennsylvania municipal plants are expressly excepted from the Public Service Company law which first became effective in that State on January 1, 1914. This is not peculiar to Pennsylvania because in other states municipal plants are excepted from regulating statutes, and the statute of Illinois so providing was held constitutional by the Supreme Court of the United States in the case of Springfield Gas and Electric Co. vs. City of Springfield, 257 U. S. 66, 42 U. S. Sup. Ct. Rep. 24.

You will find the decision in the Springfield case criticized in an article written by Mr. Paul Overton, entitled "Regulation of Municipally Owned Public Utilities," published in 7 Cornell Law Review 192, partly on the ground that the United States Supreme Court should not have disregarded the distinction between the private and public capacities of municipal corporations, and principally because of the final paragraph of the opinion of the United States Supreme

Court in that case, written by Mr. Justice Holmes, in which it is said:

> The trouble with the plaintiff's argument is that it attempts to go behind the interpretation that the Supreme Court has given to the acts concerned and to overwork the delicate distinction between the private and public capacities of municipal corporations.

I will not weary you with any legal argument as to whether or not the supplying of water to a community is a municipal duty and whether or not a municipal corporation so doing is acting in a public or private capacity, or whether in so doing it is exercising a right of sovereignty or is merely exercising the functions of a private corporation. The only point which I wish to make in this connection is that for political or other reasons municipal plants may be regulated, at least so far as the question of rates is concerned, by some tribunal other than the state utility commission.

In Pennsylvania, before 1914 the rates of private water companies were within the equitable jurisdiction of the Courts of Common Pleas of the proper county, which are the general trial courts in civil cases in Pennsylvania. When the utility commission, which is called in Pennsylvania "The Public Service Commission," was established in 1914, it took over this jurisdiction of the Courts of Common Pleas. However, it had long been held in Pennsylvania that the reasonableness of rates of municipal plants and questions of discrimination thereunder were within the jurisdiction of the Courts of Common Pleas under the general equitable powers of such courts, as granted to them by the now rather ancient statute enacted June 16, 1836. The questions which the courts had been required to pass upon under such equitable powers were such as these:

> May the municipality impose any water rates? (Jolly v. Monaca Borough, 216 Pa. 345); may it insist upon meter rates? (Consolidated Ice Co. v. Pittsburgh, 274 Pa. 588); may it charge more outside than within its limits? (Youngman v. Erie Water Commissioners, 267 Pa. 490); may it establish ready to serve charges? (Central Iron & Steel Co. v. Harrisburg, 271 Pa. 340); may it serve water to some and refuse it to others similarly situated? (Reigle v. Smith, 287 Pa. 30); may it agree to give free water to a manufacturing establishment? (American Aniline Prod. Co. v. Lock Haven, 288 Pa. 420).

The City of Lancaster now has a population of about 60,000. It has had its own municipal plant since about 1838. In 1931 it substantially increased its rates; and a citizen of Lancaster, a taxpayer and water user, on behalf of himself and others, by a bill in equity raised the question as to the reasonableness of the municipal rates.

The rates established yielded a return greater than operating expenses, and the question accordingly arose whether the City had a right to do this or as it is said, make a profit out of its water works business. This question the Court of necessity had to pass upon.

The court below enjoined the collection of the rates established. The Supreme Court reversed and, as I have said, in general held that the business of supplying water by a municipality must be regarded and dealt with in the same manner as that by a private corporation.

In my discussion of the subject with you, I do not want to refer to what has been adjudicated and say that this and that is so because it is the law as laid down in such and such a case. Instead, I want to consider what should be the law.

I probably should be frank with you at the outset and disclose that I am in entire accord with the decision of the Pennsylvania Supreme Court, and this for three reasons. The first is that I won the case, that is to say, I argued for the point of view which the court adopted; the second is that any lawyer in any State who undertakes to say that the highest appellate court in that State is in error is always in an embarrassing position; but the third and important reason is because I think the decision is right and proper and in accord with good public policy.

It does not matter whether a municipal corporation supplying water to its inhabitants is acting in a sovereign or business capacity, or is exercising a private or a public function. It is supplying an important service essentially necessary to human life. The only question is how compensation for such service should be obtained.

Municipal corporations render many important services to their inhabitants. The preservation of law and order through the police department is probably the most essential, and yet is a service which is often very poorly rendered. The operation of a fire department is, of course, important to prevent conflagration and loss of property. The opening and maintenance of streets, and the building of bridges, tunnels and the like has become of very great importance, particularly in these days when so many of us insist on riding in automobiles from place to place about our cities and towns. Parks and playgrounds and recreation centers must be operated and maintained. Sewerage systems are essential to human health. And so we could go through the long list of services which are rendered by municipalities to their inhabitants. Practically all of these services are rendered free of charge, and the cost and expense thereof is defrayed out of taxes, generally imposed upon property under some form of assessment and

to a rather limited extent by license fees of some kind or another, and in a relatively few places by taxes on income.

Still, there are exceptions to this rule. Municipal golf courses usually impose an annual membership fee, supplemented by greens fees for the occasional player. In some places fees are charged for the use of swimming pools. Tolls are charged for the use of bridges and tunnels. No doubt many other exceptions will occur to you.

Some analogy may be found in the practice of social clubs, which are a form of community or coöperative action. In addition to annual or monthly dues, special charges are made for those who take advantage of the dining rooms, use the swimming pool, take the baths, play pool, bowl, and perhaps I should add, resort to the bar.

It would seem that the just rule in all coöperative activities carried on by the government or otherwise, is that the person who receives the service should pay for the service and should pay the cost of the service rather than the value thereof.

This gives me an opportunity to call the attention of those here present who are interested in private water companies to the fact that, under the principles of regulation, rates are based upon the cost of the service, including of course not only operating expenses and depreciation, but also the cost of the money necessarily or prudently invested, or, as in the case of substantial changes in the value of our medium of exchange, the cost of the money represented by the then value of the property devoted to the service. Value, of course, is something entirely different from cost, and if rates were fixed in accordance with the value of the water service rendered, rates would be very much higher than is the case when they are determined by the cost of the service.

The difficulty with most of the functions or services rendered by municipalities is that it becomes impracticable to collect the cost of such services or functions in any other way than by a more or less general system of taxation. In the collection of tolls over bridges or through tunnels, at times traffic is so delayed or the collection of tolls becomes so vexatious and annoying that the collection of tolls is impracticable.

When we deal with the question of water supply, there is nothing impracticable in compelling payment from those who get the benefit of the service. There is also involved the question of waste, which should be avoided for the common good of all and in order to keep down the cost of the service. Consequently, I do not know that

anyone urges that water service should be rendered free of any special charge to the water users within any municipality which has its own municipal plant.

I think I am, therefore, safe in saying that it is generally conceded for very good reasons that charges for water service should be made by municipal corporations to those enjoying such service, in accordance with at least some approximately fair and equitable measure of the amount of service rendered and enjoyed.

Usually municipalities do not charge excessive rates for the water service rendered by them, and therefore the courts have only occasionally been called upon to reduce municipal water rates. We may, however, soon be faced with more cases of this kind, because our municipal authorities are searching around for additional sources of revenue. It would be manifestly unfair and improper unduly to burden the water users in order to assist the taxpayers generally, and I cannot conceive that the public would have any objection to having a tribunal empowered to prevent the establishment and collection of rates in excess of the cost of the water service rendered.

Questions of this kind have repeatedly arisen where private water companies are involved because of the desire of bondholders to receive their interest and of stockholders to receive their dividends. In many cases which have been before state utility commissions and courts, there has been worked out and developed during the course of years tests and standards as to the reasonableness of rates. As has been indicated by the decision of the Pennsylvania Supreme Court to which I have referred, the same tests and standards which have been developed with respect to private water companies are likely to be applied to municipal corporations.

However, these are days when all things are undergoing a re-examination, and the New York Public Service Commission has held that a municipal corporation may only charge rates which will meet the full cost of the service, and not such rates as will enable them to make a profit out of their operation. Just how far the New York Commission has gone I do not know, but the probabilities are that the point involved is largely one of definition as applied to the facts in the case which was passed upon by the New York Commission.

We are dealing here with various terms, namely: profit, fair rate of return, cost of money, and the like. The term "profit" is a misnomer,and in these days of regulation I do not believe anyone would seriously contend for a profit in an enterprise affected with the public

interest. But surely, if rates are to be limited to cost of service, the full cost of such service should include the cost of money prudently invested, or, as I have said, in the case of a rapidly changing value of the medium of exchange, the cost of the money represented by the then value of the property involved.

Since this convention is being held in Cincinnati, reference should be made to the case of the City of Cincinnati vs. Roettinger, 105 Ohio State 135, 137 N. E. 6, where the City was restrained from transferring to its general fund any part of the water rents collected. This decision was possible because in this State of Ohio the Legislature has limited municipal water rates to the expense of conducting and managing the water works, the repairs and enlargement or extension of the works, the payment of the interest on any loan made for their construction, and the creation of a sinking fund for the liquidation of the debt.

It would seem that this Act of the Ohio Legislature has but very little to commend it. I think it will be generally found that, if rates were established in accordance with the rule indicated thereby, rates might well be fixed by municipal corporations which would be entirely too high. It would be only the exceptional case where funds could be obtained for general municipal purposes out of water revenue, and it is difficult to see what is fair and equitable in penalizing the taxpayers who may have in years past burdened themselves unduly in order to pay off at an early date bonds issued for the purpose of constructing municipal water works.

The thing I am considering, and what seems to me the more important question is whether municipalities should by some regulating tribunal be compelled to establish rates yielding a revenue approximately equal to the full cost of the service.

No public authority wants to be under any compulsion of any other public authority, and yet, if they do not do their duty for one reason or another—and the reason is usually political—, they should be. Local public bodies are usually quite responsive to public opinion because of their close contact with their constituency. It is very easy to arouse public sentiment against the imposition of taxes or charges of any kind upon the public.

While discussing the revolutionary period in American History, we prate about no "Taxation without Representation," and yet the thing we were primarily concerned with was opposition to any taxation, whether imposed by representatives of our own choosing or not. And the public, for some psychological reason, will become enormously

upset over even a very small increase in water rates, the reason for which, I think, is because water is such a prime essential to human life and happiness.

Nevertheless, if taxes are to be kept down, waste is to be avoided, and justice is to be sought after, municipal water rates should be raised in one way or another to the full cost of the service. If councilmanic bodies will not do so, the state authorities, whether state utility commissions or otherwise, should see to it that municipal bodies operating water plants impose water rates which will bring in revenue equal to the full cost of the service.

I well realize that in taking this position I may be arousing some antagonism, but nevertheless I think my position is sound and I am submitting the same to you for discussion in the hope that, as a result of the discussion and the conflict of views, some sound public policy will evolve and the practical method of accomplishing the desired result will be made clear without arousing any undue criticism of the proper state authorities who are perhaps already being unjustly criticized because of their inability to accomplish the impossible.

TAXATION

Let me now say a few words upon the second branch of the subject assigned to me, and that is the question of taxation.

As I have said, we are looking for new sources of revenue, not only for our local governmental bodies, but also for our federal, state and county governments. The demagogue is urging higher taxes upon utilities and at the same time is clamoring to high heaven against the rates of utilities. No sane person who has given any thought to the matter can see or even imagine how taxes can be imposed upon the utilities and at the same time their rates be kept down as low as possible. It is inevitable that, as taxes upon utilities are increased, rates for utility service must increase, and that is just as true of water rates as it is of electric and gas rates.

The unthinking who are giving consideration to the greater number of society, that is, the relatively poor, and who are forgetting the common good of all, make a great uproar against sales taxes. And yet, if higher taxes upon utilities mean higher rates for utility service, it of necessity follows that taxation in any form upon utilities is in substance nothing but a sales tax upon the service rendered by the utilities.

Public utilities, whether private or public enterprises, are affected with the public interest. They are affected with the public interest

because the service which they render is highly necessary to human life and happiness and the satisfaction of human wants. A sales tax upon such service is a most objectionable kind of sales tax. As I have said, there is probably nothing so essential to human life as water, with the possible exception of the air we breathe. Why then should a tax be imposed upon water service? And yet this is what the unthinking are urging.

I do not see that this is a matter for state utility commissions, but it is a serious matter for consideration by all taxing bodies. It is the taxing bodies who should by educational and informative methods be made to realize and understand that taxes imposed upon utilities mean higher utility rates and that they are, as I have said, in substance a sales tax, in the case of water, upon service essentially necessary to human life. They should also be made to realize in the same manner that water rates are, under the regulating processes, determined by the cost of the service and not the value of the service. If they realize these things, we will not find taxes imposed upon the private corporations rendering water service.

In Pennsylvania we have a great many private water companies, probably a larger percentage than any other State in the union. About one-half of the people in Pennsylvania, outside of the rural sections, live in communities served by private water companies. Taxation of private water companies, therefore, in Pennsylvania effects a serious discrimination, in that it means that people living in communities served by private water companies must of necessity pay higher rates for water service than those living in communities served by municipal plants.

This is an improper discrimination, which I think is being recognized by the Pennsylvania Legislature now in session because it is proposed that a tax of twenty mills on the gross revenue of water companies, which is being advocated by our Government, will be imposed upon the gross revenue of both private water companies and municipal plants. This is as it should be. If taxes of any kind or in any form whatsoever are imposed upon private water companies, such taxes should be imposed upon municipal plants as well.

Nevertheless, as I have said, there is no public advantage in taxation of any form upon the rendering of water service, whether it be by private water companies or by municipal plants, because taxation of such kind is nothing but a sales tax upon one of the prime essentials to human life.

ACCOUNTING UNIFORMITY

By Harry Boggs

(*Herdrich and Boggs, Certified Public Accountants, Indianapolis, Ind.*)

A growing interest in uniform accounting is evidenced by numerous articles and addresses recently published in well known accounting magazines and trade papers. The purpose of accounting is to provide a systematic arrangement of recorded entries so as to obtain, at stated periods, a correct picture of past results. In a sense, the accounting process is a camera which provides two pictures, one a "Still" (the Balance Sheet) and the other a "Movie" (the Income or Profit and Loss Statement). Both are vitally necessary in the conduct of any business. Their value is multiplied many times when a system is standardized and uniformly adopted. Standardized accounting results are valuable for the industry as a whole, as well as for the individual corporation. Especially is this true with public utilities which are subject to regulation.

Volumes, both tragic and humorous, could be written about bookkeeping methods before the days of standardization and uniformity. Few financial reports could be understood without elaborate explanations by their makers; many were misleading and most were worthless for comparative purposes.

The Uniform Classification of Accounts for Water Utilities was projected with two principal purposes in mind:

(1) To draft a sensible system of accounts, adapted to the water business.

(2) To secure its adoption by all water companies.

The classification has had the benefit of years of analytical study by the leading public utility accountants of the United States. It has been adopted by most of the important commissions and approved by the National Association of Railroad and Utilities Commissioners.

If properly followed, the results of operations will be recorded in a uniform and intelligent manner. All will have identical instructions, definitions and terminology, and accounting information will be

considered with as nearly the same point of view and meaning as is humanly possible. The ultimate aim is to provide a classification as scientific in analysis as is consistent with soundness in practice and so universally employed as to produce results of value for comparative purposes.

HISTORY OF ACCOUNTING

Although utility regulation in the United States is of rather recent origin, legislation governing methods of keeping and presenting accounts is older than we may think.

The British Incorporation Acts of 1844 and 1845 prescribed certain accounting requirements for joint stock companies. The British Gas Works Clause Act and the Water Works Clause Act of 1847 provided that—"Undertakers must report yearly to County Officers on the receipts and expenditures, duly audited and certified by the chairman of the undertakers, and also by the auditors thereof, if any." The word "undertakers" means those undertaking the capital risk of the enterprise and is the equivalent of the "Entrepreneur" of classical economic theory. The British Water Company Act of 1871 required a "competent and impartial auditor." Perhaps the most important of these early accounting regulations is the British Companies Act of 1862 which prescribed the character of the balance sheet to be prepared by joint stock companies. Similar examples might be cited from the American Incorporation Statutes. Necessarily, however, in scope and completeness, these statutory requirements fall far short of the modern classification which was formulated by men of much experience and presented by administrative commissions under legislative authority.

Although the classification has been of tremendous value to the utilities, investors and patrons, we must not assume an attitude of uncritical satisfaction. The authors of the present classification did not consider it the final solution, but only a working basis upon which improvements could be made.

NECESSARY CHANGES IN PRESENT SYSTEM

Since the Detroit revision, many changes have occurred in financial and economic conditions and many new problems have arisen. Especially is this true of the public utility industry. As times and conditions change, and as defects are developed by practical experience, we can always see room for further improvement.

For example, I would suggest a change in the handling of uncollectible accounts. As you know, the present classification calls for building up a reserve for bad debts by charges to operating expenses. However, in principal, operating expenses are items of disbursement on account of operations. The charge for uncollectible accounts is distinctly not of this character. Lay and judicial minds have difficulty in picturing as an expense item, something which you never receive and which you never pay out. My idea is that this charge should be discarded as an expense item, but be shown as a direct deduction from operating revenues in the same manner as we now handle discounts and allowances.

The present system has been criticised on the ground that its classification of operating expenses is purely functional and unlike the classification of operating revenues, does not separate the expense data for each class of consumer service. The argument is that it should be possible to oppose sources of revenue to the corresponding expense attributable thereto, so as to disclose profitable and unprofitable classes of business and to afford a more satisfactory basis for so called "scientific rate making." Many water companies have had interesting experience along this line in rate controversies involving charges for public fire protection.

A few quotations will illustrate the point. The same question, in principal, has been raised in a recent study of apportioned cost of central station electric service to consumers served by a leading power company. In the report of that study is was said,

> "In spite of all past efforts toward computing rates on a rigidly scientific basis it is hardly mere speculation to assert that a large majority of public electric rate schedules would, upon investigation, be proved to rest upon tradition or expediency. In relatively few instances could it be demonstrated that the classification of consumers is at the same time fairly complete and completely fair. The cases are not yet the rule where each consumer contributes equitably with the others to the expenses and fair profits of the producers. Books are kept primarily for the purpose of exhibiting the extent to which the enterprise is solvent and profitable, but they can as well reflect the cost of financing and operating in such form as to permit ready and appropriate allocation among classifications."

Long before he attained his present eminence, Donald R. Richberg of New Deal fame, made the following statement:

> "To determine the reasonable rate for a public utility service, requires essentially a finding of the cost of service. The books of the company will

furnish fairly reliable evidence concerning current operating expense. It is the attitude of a regulatory body to analyze these expenses in order to determine whether they represent necessary and reasonable costs of operation, also to determine how much cost shall be apportioned to the different varieties of service furnished or to apportion rates so that they shall be in general, compensatory. . . . . This standard cannot be too strictly applied, as there may be some varieties of service for which rates fully compensatory would impose an unfair burden upon the consumers. . . . . "

Mr. Richberg's statement suggests the question and the answer. It is not the purpose of this paper to try to settle questions of rate making policy or the much controverted question of how to determine a reasonable and non-discriminatory rate for a particular class of service. In passing, however, permit me to challenge the assumption so common among regulatory theorists that either wise managerial rate making policy or regulatory standards of lawfulness, require the determination of all rates upon the dead level of apportioned costs and the term "scientific" can be applied only to rates so determined. Those who make this assumption have not thought through its implications from the standpoint of either the utility or the public.

In a recent law review article it was said:

"This is neither good economics nor good law. The cost of service is a very important item, but it is only one of many. . . . . The rate for one class of service may properly yield more than a fair return while another may yield less. Regulatory authorities have habitually made such rates. There are considerations other than return which make such classifications not only proper, but necessary. The merchant recognizes some of these considerations when he prices some articles on his shelves so as to yield a greater profit than others. . . . . Legally, cost of services is only one factor in rate making policy."

The separate ascertainment of the cost of each particular class of service will not automatically determine the rate for that class nor will it automatically determine whether that class of service ought to be fostered or discouraged. But it does not follow that to ascertain it is unnecessary or undesirable. On the contrary its materiality and importance, both at the bar of regulatory authority and at the table of management are indisputable and if the system of accounts and records of operation do not reflect it, the management may find itself at a great disadvantage. On the other hand, the present classification of operating expense on the functional basis meets a real managerial need. It measures efficiency of operation as reflected in

costs and enables management to put its finger on the sore spots. It would be a great mistake to deprive the management of the benefit of this information.

FUTURE NEEDS

To be a historian is much easier than to be a prophet. I do not wish to assume the prophetic mantle, but it is not improbable that we may eventually be required to keep our accounts and records so as to show the cost of each class of service as well as the functional cost now shown. In that case the contents of the operating expense accounts must necessarily be determined either by operating functions or by classes of service. Whichever basis is adopted, the information required by the other basis may be currently obtained by establishing subsidiary records of current operating statistics, surveys and study data, and developing therefrom, for each accounting period, ratios or factors which applied to the operating results, exemplified by the books of account, will produce the information desired.

My own feeling is that the functional basis should be retained. That to establish and keep such sub-accounts would be unduly burdensome. However, it may become necessary to establish subsidiary statistical records capable of currently producing the required ratio or factors.

Permit me to offer a few practical suggestions for accounting improvements in line with the uniform classification. Those utilities who are not at present keeping their accounts in conformity with the uniform classification and who wish to secure the advantages to be derived from such practice should immediately secure an accurate analysis of their Fixed Capital account on either a cost or present value basis. If the plant is comparatively new, the cost can be obtained by investigating the financial transactions since the beginning of construction. But water utilities of recent origin are few. In many instances it is very difficult, if not impossible, to obtain useful information from a study of ancient records, particularly as to accurate capital costs. In such cases the plant should be appraised by a competent appraisal engineer. While engaged in this task, the engineer will ascertain the necessary details of plant composition or a breakdown of the Fixed Capital into detailed accounts, which may be used by the accounting department in clearing displaced or abandoned property from the records and in determining the proper

charges for Retirement Reserve. Incidentally, recent Federal regulations and Supreme Court decisions practically require the maintenance of proper plant records as the basis of proof for proper retirements or depreciation charges, both in Federal tax returns and in rate controversies.

With proper detail of the fixed capital assets at a given date, it is then necessary that you install a system of accounts and method of procedure for the purpose of collecting and summarizing financial and statistical data based on the uniform classification. Every person maintaining these records and sharing in the responsibility for their accuracy should be thoroughly familiar with that part of the system affected by his duties. That definitely done, the system should not be cumbersome or necessitate an undue increase in the office force.

The cost of the system will be more than compensated by the advantage of having complete and accurate data immediately available for a single rate controversy, or refinancing, or purchase and sale and for such governmental and other reports as may be required.

The uniform classification of accounts is concerned not only with cash receipts and disbursements, but with conditions not yet reflected in cash transactions and with changes in capital assets by reason of technical progress, replacements, ordinary depreciation and other causes. However, small water utilities, both private and municipally owned, and we must confess, some of the larger utilities, still keep their accounts almost entirely on a cash basis, and record no financial transactions which do not immediately affect cash. For example, the classification in accordance with proper accounting practice requires that when meters are read and bills prepared, "accounts receivable" must be charged and the appropriate revenue accounts concurrently credited. These utilities, however, merely file duplicate bills or make entries in memorandum consumers accounts which are not co-related with the general records. The operating statements prepared therefrom fail to show revenue earned, but not collected and liabilities incurred but not paid. They also improperly include revenue and expense from previous periods. It is by no means uncommon to discover annual reports containing but one statement showing only cash receipts and disbursements. This type of statement wholly fails to reveal the true financial condition or the actual operating history. The balance sheet is distorted by the omitted liabilities which may in turn effect the recorded value of

the plant and other assets. The costs of operation are also misstated in total and details by reason of the lapover periods.

Strangely enough, it is difficult to convince some executives of the importance of establishing the accrual basis. Without it the management will always be uncertain as to the truthfulness of the operating statement. As concerns the balance sheets, the dubious consolation of uncertainty is not available, for necessarily, such financial statements are incorrect.

There is frequently a lack of clear understanding of the correct distribution of certain items among the expense accounts. If there is error at the source, the results are misleading. Those who are responsible for results should insist that every person—high or low—who furnishes data or makes reports used by the accounting department must acquire a real understanding of the accounts affected thereby. This may require further training of some executives, divisional or departmental heads, also some education of gang bosses and timekeepers who should at least know how to prepare the daily time cards to report correctly the nature of the work done so that proper accounts can be charged therewith.

Recently one of the largest public utilities in the United States, realizing the importance of accuracy at the source, inaugurated classes dealing with the general theory of accounts, and specifically with the accounting methods and problems of the system. One who occupies a minor position in that company told me that before taking the course he had regarded the many required reports as part of a vague, complex, vexatious and utterly useless something, popularly known as "red tape." Although he had conscientiously prepared them, it was with the feeling that they were burdens wished upon him by some high official who took malicious pleasure in placing unfamiliar terms along the top and left margins of closely ruled paper and sending them along the line to be returned eventually to the home office, where they would be filed away until need for additional storage space necessitated their destruction.

But after he had attended a few of the classes and had wrestled with the problems involved, he began to learn the need for accurate detail and the despised reports took on a new importance. He gained a different insight into the many phases of the company's organization and came to appreciate the relation of his own department to others in this great corporate structure. He realized the necessity of accumulating numerous financial and statistical facts required

for writing its history and planning its future. New thought was given to the methods of gathering and checking information and he took a greater personal interest in the accuracy of his own work. He realized that even the smallest cog is a vital part of the largest machine and that each unit must perform its assigned task. I venture the prediction that companies establishing such educational classes will be agreeably surprised at the benefits derived therefrom.

MORE COMPLETE USE OF ACCOUNTING SYSTEM

As a final suggestion, in which I take the risk of incurring some displeasure, permit me to say that some executives do not sufficiently appreciate the importance of a proper and adequate accounting system, nor do they sufficiently utilize the benefits of such systems as they may have. When the financial statements are submitted, these executives satisfy themselves as to the condition of the cash, but devote too little time to an analysis of the other features of the statement which have a direct bearing and ultimate effect upon the bank account and which require close attention and careful analysis by the management if the interests of the enterprise are to be protected. Unless the company has the benefit of a proper system, the accounting department, whatever its merits, is unable to furnish adequate information which the management should have.

ACCOUNTING IN MUNICIPAL UTILITIES

We have been hearing and reading a great deal about "Private" vs. "Public Ownership," low municipal rates, taxless towns, etc. The major solution of these controversies is proper and uniform accounting. The municipal utilities are particularly in need of improvements in this respect. The principal reason for this accounting laxity has been the limited tenure of administrative offices, which are changed every two or four years, sometimes oftener. Frequently, no sooner does the utility auditor or manager become familiar with his duties, and is able to determine where improvements are necessary, than he is displaced by a change in political administration. Fortunately the absolute necessity of employing and retaining efficient public servants in administrative positions, particularly in accounting and other technical personnel, is being more and more recognized, with a view of efficiency in operation and truth in accounting. Today many publicly owned utilities are operated as ably as those privately owned. They are not disturbed by political

changes because after all some politicians are sufficiently intelligent to recognize that efficiency is paramount to politics, in fact, is the best politics. If the taxpayers demand competence in municipal utilities the politicians will give it to them.

We have come to realize that a lot of goodness is hidden under the skin of municipal ownership, but this must depend on purging technical jobs of politics and placing them on the merit system. When this condition becomes more general, much of the smoke from the battleground will blow away and a cleaner and clearer picture will be presented. With capable personnel and approved accounting systems, the municipal plants will be enabled to present proper financial statements, showing the actual source of income and the actual expense incurred, so that taxpayers and patrons may know just what their property is doing and why it is doing it, and may thus formulate intelligent opinions of their own, rather than having to depend upon the statements of others who may be misinformed or may have an ax to grind.

The average patron is primarily interested in good service at reasonable rates. He wants to know that the cost of his service is not excessive as compared with that of like utilities. This can be accomplished by the use of the uniform classification of accounts. With that as a foundation, the facts can be recorded in books adapted to individual requirements. When the final statements are prepared, the true costs will be disclosed and a dependable comparison can be made with other utilities. Immediately any differences in cost will be revealed and the reason for such variations should be readily obtainable.

Before any intelligent or fair comparison can be made between the cost of public and private plants, we must first establish the relative costs on a comparable basis by applying the same accounting standards to each. We must know that all costs are reflected in the books, that depreciation has been properly recognized, that the element of tax burdens or tax freedom has been considered, etc. Then we must consider the physical lay-out of each plant and the conditions under which it necessarily operates, such as source of supply, kind and degree of treatment, etc. We must have all the variable factors and make proper adjustment for them. Then only can a proper comparison be made. No helpful conclusions can be reached by a simple comparison of rates in effect without allowing for the variables.

In this connection a bill known as the Shannon bill was recently

introduced in Congress, the provisions of which were to require all governmental units to include in their cost estimates which they prepared, not only items of actual cash outlay which would be needed, but such factors as taxes, insurance, interest and depreciation, etc., all of which the private bidders must consider, so that a fair comparison could be made as to actual costs, and whether, as a matter of fact, the government was fairly or unfairly competing with private enterprises.

In closing, let me say that the present Uniform Classification of Accounts for Water Utilities, which has been approved by the majority of State Commissions and is now in general use, is the foundation upon which all water companies should build their accounting records. It classifies the Utilities into four divisions, based on annual revenues and its flexibility is such that, despite vast differences in volume of business between the larger and smaller plants, sound accounting principles are maintained and uniformity prevails throughout.

Some people believe that because water comes from the heavens it should be free, but we all know that it travels a long road before it reaches the faucet. It is this journey from the sky to the spigot that creates the cost of service. The cost of service creates the rates and the rates create controversies. If the cost can be properly shown, controversies over rates should be practically eliminated. True and comparable costs can be shown only by the proper use of the uniform classification. The management of every water utility, in fairness to itself as well as to the patrons, should adopt and use the uniform classification and see that it is intelligently administered. This applies to both the private companies and to municipal plants where every taxpayer is a stockholder.

DISCUSSION

W. S. Patton (*Ashland, Ky.*): Every person here will readily agree with Mr. Boggs that all water plants would be much better off *if each used the same standardized classification of accounts. It would enable one plant to compare its operating expenses with those of other plants and by use of this system much uncertainty about what is included in various accounts would be eliminated.*

The American Water Works Association has devoted considerable time and effort toward the adoption of a uniform set of accounts and various papers have been read on the subject, the earliest being in

the year 1888. In 1920 a committee composed of Albert H. Wehr, Dow R. Gwinn, John Caulfield, Emil L. Nuebling, Alfred M. Quick and W. S. Kuhn prepared a report consisting of 304 pages entitled "A Uniform Scheme of Accounts and Reports for Water Supply Enterprises" which is very complete, but insofar as I have been able to ascertain the Association has never officially adopted a uniform classification of accounts, unless it is this report of 1910.

Just why so little has been said about this very complete work is hard to understand, unless it was because we had no Finance and Accounting Division and most of the members attending the conventions were more interested in problems of operation than of accounting.

The Uniform Classification of Accounts for Water Utilities to which Mr. Boggs refers was prepared in 1921 by a committee of the National Association of Railway and Utilities Commissioners and is being used by the various State Public Utility Commissions. I consider that the National Association of Railway and Utilities Commissions has performed a very valuable service in the water works field. By compelling every water works plant operating under their jurisdiction to put into operation their "Uniform Classification of Accounts" a task has been accomplished in a few years which would have taken our Association a lifetime to accomplish. There are still many states which do not have Public Utility Commissions so a large field remains for constructive effort on the part of our Association. As Mr. Boggs has pointed out, *the value of a uniform classification is multiplied many times when a system is standardized and universally adopted.* If this is the case, would not this be a good time for those of us who are not under a uniform classification to make the change?

It is hard to overcome the inertia of changing any system to which you are accustomed, but in adopting a uniform classification of accounts you are not required to change your whole accounting system but only the titles or names of the accounts so that certain expenses, capital items, liabilities and etc. can be grouped and listed the same as other plants using the same classification. If your books do not show the value of the various units which comprise your capital account it will not be as easy to make this change as it seems, unless you are familiar with construction costs, but Mr. Boggs in his paper gives us some good advice. He suggests that a reliable appraisal engineer be employed to make an appraisal of the plant and to ascertain the value of these various units included in the capital account

so that they may be carried on the books at their present day true value. This is good business and a good investment for the utility. We are entering a period of great trouble and tribulation for the water works business. Already the cost of furnishing water has commenced to rise and with increased cost of operation and increased taxes we must be prepared to demand increased prices for our services. At all times our books should show the true investment in our properties and no matter whether the plant is privately owned or municipally owned all facts should be shown.

There is one recommendation, however, that Mr. Boggs has been too modest to make and that is to employ a good accountant as well as an engineer, unless the plant already has a modern accounting system. It is as necessary to know the cost of furnishing service as it is to know the true investment in your plant. Yet how many municipally owned water plants have the notion that certain kinds of service cost nothing? If scientific rate making were adopted, how many plants would continue to furnish automatic sprinkler service free, or for a nominal charge, and how many cities would allow municipal water plants no credit for fire protection? If the water consumers were furnished with the facts there would be immediate demand that property owners should pay their just proportion of the operating costs.

The time has come when the American Water Works Association should adopt some form of uniform classification of accounts and it should furnish to each member a standard set of accounts with full instructions for their use. At the New York convention Mr. Schultz suggested:

(1) That this Division at its executive session adopt a resolution approving the compilation of a uniform classification of accounts suitable for both publicly owned and privately owned plants.

(2) That a committee be appointed for the purpose of circularizing the entire industry in order to ascertain its willingness to put in use such a classification; and if the majority agree.

(3) Appoint a joint committee representing both types of ownership in order to draft an ideal uniform classification.

If this suggestion has not been acted upon, I suggest that this be taken up at this convention and that this committee be appointed so that there will be no more delay than necessary.

A REVIEW OF THE SPECIAL LIEN BOND SITUATION

By Robert A. Taft

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The subject assigned to me is an interesting one because of the recent growth in importance of special lien bonds, and the fact that ultimate experience with these bonds is so limited that definite conclusions are hard to form. Unquestionably, special lien bonds issued for water works purposes have a better record during the depression than general bonds, and this fact alone has led to an increasing favor and an increasing number of issues of all kinds of special lien bonds. It is becoming more and more important that the exact nature of this method of financing be analyzed correctly, and its soundness determined. It is just as important to point out the dangers which might develop in this system as in any other system which becomes popular and, therefore, likely to be overexpanded.

There are several different kinds of bonds which might fall within the definition. I should define a "special lien bond" as a municipal bond, payable out of the revenues derived from a particular utility or property, and not a general obligation of the municipality which issues it. There are bonds which are both made a special lien on utility revenues, and also a general obligation of the municipality, but these should be classified rather in the group of general bonds than in that of special lien bonds. In current use, a special lien bond is properly defined as such, even though it is not secured by a mortgage on the utility or property, but is only a lien on the revenues of such utility or property, which, under the law authorizing the issue, must be devoted solely, after the payment of expenses and maintenance, to the payment of interest and principal of the bonds. It is true that in such a case there really is no lien at all in the legal sense; there is merely a right to have the public officials apply this money to the payment of principal and interest, but popularly this right is spoken of as a lien. There are many special lien bonds which are also secured by a direct mortgage on the utility or property, and in such cases, where a public utility is involved, it is not unusual to provide

that in case of foreclosure the mortgagee shall have a franchise to operate the utility. The additional security given by such a mortgage and conditional franchise would seem to be of considerable value, and if the special lien bond is to be developed, I should think that this feature ought to become almost universal.

Special lien bonds are not a new development in the United States, and they may be found among the earliest municipal issues. They were used to finance the construction of municipal railroads in the days when cities were promoting their future expansion by connecting themselves with what they considered their proper markets in all directions. (See, for example, *Adams v. Memphis R. Co.*, 2 Coldw. (Tenn.) 645.) In those days the bonds were usually issued to contractors, but they did not achieve an enviable reputation any more than did the general bonds issued for the same purpose. In many States, such as Kentucky, special lien bonds have been issued for the construction of improvements built through the levy of special assessments, and here again contractors were as a rule asked to accept bonds of this kind, and rely upon the collection of the assessments levied. (See *Paducah v. White*, 244 Ky. 733.) More recently, special lien bonds have been issued to finance the purchase or construction of water works, street railways, bridges, and electric light plants. (*Scott v. Tacoma*, 81 Wash. 178, is a street railway case.)

In determining the soundness of the method of financing by special lien bonds, we must remember that, even more than in the case of general bonds, the special circumstances affecting the particular issue are of tremendous importance. We must look at the soundness of method from the point of view both of the individual bondholder and of the municipality issuing the bonds. In the long run, the interest of these two is the same. If the method of financing provides a sound investment, than it is one which the city is able and likely to pay off without undue burden on its future residents. I think, however, that this community of interest does not necessarily extend to the municipal bond dealer or the municipal utility engineer. These groups are necessarily interested in the immediate profit to themselves in increasing the number of bonds which can be marketed, and the number of utility plants which can be built or expanded. To them there may be an advantage in the mere fact that special lien bonds are ordinarily exempt from bond limitations, and may be issued regardless of the financial condition of the city, whereas this very fact ought to lead the city and the bond purchaser to look on the

bond issue with some suspicion. Glowing accounts of the superlative results to be accomplished through special lien bond financing, issued in the form of pamphlets or magazine articles by bond dealers and engineers, may not be entirely unprejudiced.

LEGAL AND CONSTITUTIONAL QUESTIONS

The first question which arises in the case of any municipal bond is whether it is issued in accordance with legal and constitutional provisions. Of course, the constitutions and laws of every State are different, and of course bond dealers always require a legal opinion before placing the bonds on the market, so that the buyer is not usually concerned with this feature. But the question whether special lien bonds are within constitutional or statutory debt limits is of vital importance to many municipalities, and has given rise to more litigation on the subject of such bonds than all other questions put together. (See the notes on the subject in 59 Lawyers' Reports Annotated 604; 37 L. R. A. n.s. 1085; L. R. A. 1917 E 447.) The general rule is that these bonds are excluded from constitutional limits on the ground that they are not "indebtedness," although there is a vigorous dissent, notably in Illinois and Pennsylvania. Statutory limits are usually specific, and of course more flexible. In the effort to take advantage of Federal P.W.A. grants, nearly all the legislatures have now excluded these bonds from debt limits if they have the power to do so; and some State constitutions, as in Ohio, have done the same.

In principle, it would seem that indebtedness payable only out of a special fund is nevertheless indebtedness within the language of a constitution as much as any other indebtedness. On the other hand, in theory, a public utility or an assessment project should be self-supporting, and if it is self-supporting, there is no reason to include the indebtedness in a general bond limitation designed to hold down debt and tax rates. The only difficulty with this theory is that it is often impossible to determine, particularly in advance, whether the bonds issued are in fact self-supporting or not. Water works have such an excellent record of self-support that even in Ohio, where the bond limitations on utilities have been strict, water works have always been an exception, and water works bonds assumed to be self-supporting on a simple certificate. But, in general, it is just as easy to fool the voters, and even city officials, with a magnificent pro-

spectus of earnings as it is to fool the investor who buys private or public bonds.

The policy of municipal debt limitation constitutes one of the soundest fiscal policies adopted by our States, and the popularity of special lien bonds should not be allowed to break down that structure. If they are to be wholly excluded, then there should be substituted some other form of check to determine that they will probably be in fact self-supporting, for the protection of both the municipality and the bond-purchaser. In short, the particular project covered by the special lien bond must be critically examined from a business standpoint, and the question of legal debt limitation is almost identical with the business questions I shall discuss a little later.

Before considering these business questions, however, we may well examine the other legal characteristics of these bonds. Is the interest and principal as likely to be paid when due as in the case of a general bond, and is the remedy on default as adequate? In recent years attention has been called more and more to the importance of adequate default remedies, and it is fair to say that the adequateness of the default remedies provided affects materially the likelihood that current payments of principal and interest will be made. For instance, in New York City today the tremendous cost of foreclosing small mortgages has encouraged debtors to discontinue all payments in order to club the bondholders into reductions of interest. The inadequacy of legal remedy against a sovereign state undoubtedly encouraged the default made by the State of Arkansas on its solemn obligations. If the special lien bond contains adequate provisions for receivership or foreclosure, I believe that the legal remedy is probably more effective than the remedy in the case of general lien bonds. The courts have laid down the definite rule that they will not appoint receivers for public corporations, even limited corporations like drainage districts or sewer districts (See *Depew v. Venice Drainage Dist.*, 158 La. 1099; *Paducah v. White*, 244 Ky. 733, *Quindry, Bonds and Bondholders*, Sec. 423), except where the district is dissolved, or a receiver is authorized by statute (See *Guardian Savings Bank v. Road Dist.*, 267 U. S. 1; *Beck v. Otero Irrigation Dist.* 50 Fed. 2d. 951). If, however, the laws authorize a mortgage, the courts will usually uphold foreclosure with its attendant remedy of receivership. (See *City of Santa Cruz v. Wykes*, 202 Fed. 357, where foreclosure was allowed against a city water works; also *Dreyfus v. City of Socorro*, 26 N. M. 127; *Adams v. Rome*, 59 Ga. 765.) The very fact that this

remedy exists will make the public officials more anxious to pay these bonds, whereas too many public officials have learned that the bondholders' remedy in the case of general bonds is long, complicated, and uncertain. The courts admit the principle that public officials may be mandamused to levy a tax for the payment of general bonds, but they are loath to exercise this power, and there are many obstacles, such as tax limitations, which make the working out of the principle uncertain. In times when low returns from taxes make uncertain the payment of the salaries of school-teachers, policemen and firemen, not to mention the higher city officials, the people, and even the courts, come to regard the payment of interest and principal on general bonds as a secondary consideration. On the other hand, a possible foreclosure on a municipal plant, while humiliating to the officials of the city, does not deprive the people of any essential service, and is not such a severe interference with public service as will prevent a court from granting a sale on foreclosure. It is difficult to find in the books many cases where foreclosure has actually been necessary.

The special lien bondholder has a preliminary remedy in mandamus against public officials to require them to see that rates are maintained sufficiently high to meet the interest and principal payments due, and to see that the moneys received are actually applied to such payments, and not diverted for general purposes. In the case of water works, this remedy should be sufficient, but there is a question whether, in other enterprises less sound from a business standpoint, the raising of rates when necessary will be quite so simple. As a practical matter, I have been unable to find any case where this remedy has been actually applied.

Of course, a special lien bond does not have behind it the general obligation of the municipality, and in the event the particular enterprise fails, the special lien bondholder will lose, although the city itself may remain in excellent condition. This situation perhaps reduces somewhat the excellence of the moral risk, because the city naturally will not have the same feeling about maintaining its credit as if the bond were a general bond. Recently the whole moral standard of debtors has broken down to such an extent that the question seems less important, but we may well return to times when the general moral responsibility of the borrower is again sought after. Looking at the whole situation, however, from a legal standpoint, I should say that the holder of special lien bonds is just as

favorably situated, and possibly more so, than the holder of general bonds. The soundness of the bonds, however, depends far more on the particular business risk than in the case of general bonds, and that risk must be examined carefully in each case.

FINANCIAL SOUNDNESS OF SPECIAL LIEN BONDS

The fundamental question, however, in the case of special lien bonds is the soundness of the business enterprise on which they are based, and they are more comparable to private utility bonds than they are to the ordinary municipal bond. In times of extreme depression such as we have lately seen, municipal bonds have been weak because of tremendous tax delinquencies. Utility bonds, both public and private, escape this danger, because people pay their water and light bills more regularly than taxes. But this is an abnormal situation, which we are not likely to see again, and if it recurs often we are not likely to find a sale for any municipal bonds. Special lien bonds depend for their strength on the profitableness of the particular enterprise, on the way it is managed, and on the way it is financed. In one important respect they compare unfavorably with a private utility bond from the point of view of the investor. They represent ordinarily the whole cost of the project, whereas the bonds of a soundly-financed private utility should not exceed say fifty percent of the value of the property. Of course there are private utilities which have issued bonds for one hundred percent of their value, and there are municipal plants, like the Cincinnati Waterworks, which have so reduced their indebtedness that the outstanding bonds are less than half the present value of the plant. But the proponents of special lien bonds do maintain in theory that they may be issued for the whole purchase or construction cost of a utility plant, although that plant is the sole security. No one contends that a private utility should be so financed. This seems to me the most fundamental objection to special lien bonds. They are to a large extent equity securities masquerading as bonds. There is no way I see to escape this difficulty except for municipalities to issue general bonds for half the cost of a plant, and then issue special lien bonds only for the other half. This has never been done that I know of, and as long as the public will buy special lien bonds for the whole cost, there is no particular reason, from the point of view of the municipality, why it should be done.

To some extent this disadvantage is balanced by the freedom from

taxation and governmental interference which a municipal plant enjoys. It may be said that the municipality contributes to the value of the plant by waiving its right of taxation, but if the bondholder has to foreclose and undertake the operation of the plant, the company he forms is promptly subjected to taxation. Of course, if the time ever comes when the municipal plant is asking its creditors to cut down their debt, this unpleasant alternative of taxation in case of foreclosure will be a powerful argument to force concessions from bondholders, and let the city continue to operate.

I do not intend to discuss here the desirability or undesirability of municipal ownership of public utilities, but it is obvious that if municipal ownership is not a success, the special lien bonds issued for the cost of the plant are not likely to be good. In determining the soundness of a particular issue, therefore, the likelihood of satisfactory operation in the city owning the plant is an important factor to be considered. But even more than this, consideration must be given to the nature of the utility, and the demand for its products which may exist in the community.

Water works bonds undoubtedly have an excellent record, and, as far as we can see, the industry is one likely to maintain this record. Municipalities have made their greatest business success in this field. The commodity is so essential, and is intrinsically of such indefinite value compared to its cost, that the raising of rates does not present any insuperable difficulty. Price-raising neither produces a substitute, nor cuts down consumption, except perhaps in the case of very large users. I think we should recognize, however, that this is a feature resulting rather from the nature of water than from the nature of special lien bonds; and we should not allow the water works precedent to lead us on to other unlike industries.

I have already suggested that the record of special lien bonds in the early days of railroading was not one to be proud of. If in the nineties, when the street railroads were being built, they had all been built by municipalities, and special lien bonds issued for their construction, I am afraid that the record of those bonds today would be as unsatisfactory as that of the bonds of the private traction industry, and more so because there was usually considerable equity behind the bonds of private traction companies. Faced with decreasing traffic, increasing competition of buses, automobiles and jitneys, faced with a public demand for a five-cent fare, the cities would have met the same difficulties as the private companies. In New York today, and in

other cities, a low fare is maintained by a subsidy from general taxation. Would a city be willing to grant such a subsidy in order to support the holders of its special lien bonds? We probably would have seen many cases of foreclosure, and many cases in which the bondholders acquired a broken-down system, just as we have seen in the case of privately-owned street railroads.

The situation of electric-light plants is not as good as that of water-works, but certainly we cannot indiscriminately condemn special lien bonds issued for such plants. There is considerably more danger, however, to the investor than in the case of water works. During the past twenty-five years, the electric industry has been steadily growing, with constantly decreasing costs, an industry in which private owners also have made perhaps more money than they were entitled to. Will it be so successful in the future? If the industry becomes less profitable, will any city plants fall by the wayside? Will they keep up with the procession, so that if the bondholders have to foreclose they will find a modern system, in good operating condition? These are questions which a purchaser of special lien electric-light bonds should certainly ask himself, in view of the lack of equity behind his bonds.

The extension of the policy to bridges seems to me to offer a real danger to the special lien bond situation. Bridges are not like water works. Every bridge has its peculiar state of facts. The rates which it must charge to pay its sinking fund and interest vary from ten to fifty cents per automobile, or even more, according to the location of the bridge. When a new bridge is built, it is almost impossible to predict with accuracy the traffic which will naturally drift to the particular bridge. It is impossible to tell what political pressure may be brought to bear to reduce rates. At least in recent years, the bridge promoters have been almost more unreliable than promoters in other classes, and many bridge issues, both public and private, are in default today. I do not mean to say that special lien bonds should never be issued for bridges, but they should be confined as far as possible to the purchase of existing bridges, and based on extremely definite figures as to income.

DANGERS

What are the dangers of expanding the practice of issuing special lien bonds? I should say that the principal danger lies in the ease with which they can be issued. If a municipality is hopelessly in-

volved in its existing debt and taxation problems, it seems to me unwise that it go into any new enterprises until those problems are solved, but the special lien bonds afford a means of doing so. The very fact that no other bonds can be issued for public works is used as an argument for issuing bonds of this kind. The fact that the bonds are not subject to federal income tax makes it easier for a city to issue them than a private utility. If a private company attempts to finance a new utility, it would be scrutinized today with much greater care by the investor than a special lien bond issued by a municipality; yet the risk to bondholders in the case of the municipality would probably be greater than the risk in the other. No city should come to regard special lien bonds as a magic method of lifting itself out of financial difficulties. Let no city be deceived by attractive circulars showing how Podunk, Missouri, pays all its expenses out of the revenues from an electric-light plant.

From the point of view of the bondholder, the danger is somewhat different. The investor does not distinguish carefully between special lien bonds and general bonds. He does not ordinarily realize that the city whose name is found on his bond expressly disclaims any responsibility for the payment of the bond. It is the duty of the bond dealer to impress upon him, as many do, that the bond is a special lien bond, and that he must look alone to the soundness of the enterprise on which it is based for his security. Unfortunately, the necessary information is not forthcoming in the case of ordinary municipal bonds, or even special lien bonds, to the extent which gives a clear and complete picture. They are exempted under most state blue-sky laws. The Federal Government has not attempted any control. In fact, through the P.W.A. and the R.F.C., they have deliberately encouraged the issue of special lien bonds by municipalities for utility plants, and have passed them on to the public without all the information which the Securities and Exchange Commission deems necessary in the case of private companies. The P.W.A. has encouraged legislatures to put special lien bonds outside of debt limitations, and at least fourteen acts have been passed in two years for that purpose. I believe that the Securities and Exchange Commission should require from municipalities, particularly on special lien bonds, the same kind of financial statements and business reports which they require now from private companies whose bonds are listed on the exchanges. This Division has just heard a discussion of uniform classification of accounts suitable for publicly and

privately owned utilities. For the sake of the investor, such a classification is not only desirable, but absolutely essential, and it would eliminate one of the greatest dangers existing in the special lien bond.

The investor should be warned, also, that since the bond is in fact a business bond, issued for one hundred percent of the cost of the business, he is more interested in the operation of the property than he would be even in a private utility. Many things may happen to a utility. In the case of the private utility today, there is a trustee of the mortgage, who assumes a certain responsibility to look after maintenance; to see that the property is properly operated. The Trustee of The Cincinnati Street Railway Company, for instance, requires that the budget contain every year a definite amount for amortization, maintenance, and depreciation. In the case of a municipal bond, there is seldom such a trustee. It is entirely possible that the property may be inefficiently operated, perhaps more likely in the case of a municipal utility than in the case of a private utility. It is entirely possible that the plant may fall behind the times, particularly in the electric field, where new developments are leading to constantly improved machinery and an unusual amount of obsolescence. It is possible that enthusiastic officials may overexpand the system, or burden it with unnecessary frills, to a greater extent than in the case of private utilities.

An additional desirable protection both to the city and the investor is the issue of special lien bonds in serial form rather than with sinking fund requirements. The absence of a trustee for municipal bonds makes a sinking fund a good deal more subject to attack in municipal issues than in private issues. The best city officials may yield to tremendous pressure when essential current services are threatened, and it is far better to retire the bonds annually as the revenues accrue.

In short, the holder of a special lien bond finds himself subject to exactly the same kind of dangers that the holder of a private utility bond is subject to, and a few more. The important thing is that he realize that he has not a municipal bond but a utility bond, usually for one hundred percent of the cost of the utility, and that he not allow himself to be dazzled by the fact that the bond is not subject to federal taxation. There is another reason why he should not allow himself to be dazzled by that prospect. I have never felt at all certain that the Federal Government might not constitutionally in-

clude the income from municipal bonds in the federal income tax, providing it is not discriminatory or confiscatory. That, however, is a little remote from the subject of this paper.

CONCLUSION

In conclusion, therefore, let me say that in my opinion special lien bonds are legal and constitutional, and the legal remedies provided for their enforcement are probably superior to those of general lien bonds. But there is a fundamental difficulty that ordinarily they represent a one hundred percent mortgage, and we have found in recent years that one hundred percent mortgages on houses, office buildings, apartments, and private utilities are not likely to survive a depression. In the case of water works bonds, this objection is overcome by the extraordinary stability of the industry as an industry, and its success up to date in avoiding political manipulation. But there is great danger in the indiscriminate extension of this method of financing, because it is based on a hundred percent mortgage, and because neither the cities nor the bond-buyers seem to realize that it should be subject to the same criticism, examination and analysis which any private industry is subject to. That danger can only be met by the education of city officials and investors, and by the development of an adequate system of investigation and reports, under the supervision of State or Federal authorities.

DISCUSSION

STEWART A. HOOVER (Attorney at Law, Columbus, Ohio): Mr. Taft's review of the special lien bond situation could not fail to be of extreme interest to the members of the American Water Works Association, for in his analysis he has pointed out clearly the advantages and disadvantages of a method of financing publicly owned utilities that is foremost in the minds of all of us who are interested in the development of municipal water plants.

These so-called special lien bonds or mortgage bonds pledging the property of the public utility and/or the revenue from the same, have not usually been viewed with favor by city councils as a proper method of municipal financing. Members of city councils who would not hesitate to issue bonds which pledged the full faith and credit of all of the property within a municipality, hesitate to execute a mortgage which pledges only a specific portion of the property or the revenue therefrom. In the mind of the average city council there is a

distinction between a bond and a mortgage, a bond being viewed as a dignified and respectable way of financing, and a mortgage as exactly the opposite.

In recent months the federal recovery program has brought about a change in the attitude of municipalities toward mortgage or special lien bonds. The Federal Government has provided vast sums of money for PWA projects, which are available to municipalities in the event they are able to devise some method of financing which will convince the Federal Government of the solvency of its investment.

The provisions of the various state constitutions limiting the borrowing power of municipalities and other political subdivisions, in many instances prevent the issuance of any additional general obligation bonds. This is particularly true in Ohio since the decision of our own Supreme Court in the case of The State, ex rel. City of Portsmouth vs. Kountz, Mayor, et al., 129 O. S. 272. In this case the court held that the constitutional provision imposing a tax limitation of ten mills, by implication also imposed a debt limitation; that in computing the millage required to meet debt service, there must be included in the total debt service all overlapping bonds of political subdivisions, and all outstanding special assessment and public utility general obligation bonds which are in practice serviced from receipts other than taxation.

This decision will prevent the issuance of any more general obligation bonds in many municipalities in this state for the construction or extension of water plants. For this reason, in many instances, the hope of the municipality of owning its own water plant or of enlarging its existing plant by use of PWA funds, rests on the legality and marketability of revenue or mortgage bonds to be issued for that purpose.

In this discussion I have taken the liberty of confining my remarks to that part of Mr. Taft's paper which refers to revenue bonds for municipal water utilities.

The legality of such issues must be determined by the provisions of your state constitutions and statutes. These provisions vary to such an extent as to preclude their discussion here. The marketability of such mortgage or revenue bonds depends, of course, on whether the bond investor believes that he can get back his investment, together with a fair interest return thereon. As Mr. Taft has pointed out so clearly in his paper, the fact that these mortgage or special lien bonds are not general obligation bonds, makes necessary a careful examina-

tion of the factors involved in each individual case. No municipality should issue, nor should any investor buy, revenue or special lien bonds, except after due consideration of certain fundamental factors involved.

If you intend to participate in PWA funds by issuing any special lien bonds, such as revenue or mortgage bonds, you will be compelled to furnish to the Federal authorities such information as will convince them that their investment in your particular utility is sound. If you intend to sell your mortgage or revenue bonds on the general market, you should be in a position to furnish the investor with the same kind of information. It is the purpose of my discussion to try to bring out what seem to me to be some of these fundamental factors.

1. How ample is the source of supply of raw water? Is it adequate for the immediate needs of the municipality and the future needs, at least for a period extending over the duration of the bond issue?

2. What is the nature of the source of supply of raw water?
   a. Is it a hard or soft water
   b. Will it respond at a reasonable cost to treatment
   c. What will be the cost of treatment necessary to remove objectionable mineral content
   d. After treatment, will it be a clear, tasteful and satisfactory water for domestic and industrial consumption
   e. Have the plans for the utility been approved by the health authorities in the state in which the plant is located
   f. How does the cost of the plant, based on capacity, compare with the cost of other successfully operated municipal plants.

3. What consumption may reasonably be expected? The consumption will depend not only on the number of consumers to be served, but also upon the nature of the industrial plants in the municipality. Do these plants require a quantity of water, or a quality water? If they need only a large quantity of water, and this quantity is readily available they may install their own supply rather than pay the increased cost, necessary to produce a quality water. If they need a quality water, will the municipal supply of the plant in question meet their needs, and if so, is the municipal rate sufficiently high to permit a profit to the municipality and at the same time sufficiently low to permit its use by the industry.

4. What rates are provided to be paid by domestic and industrial

consumers, and how do these rates compare with the rates prevailing in cities where municipal water plants are being successfully operated?

5. What hydrant rentals are provided to be paid by the municipality? Are the hydrant rentals so fixed, above or below cost?

6. What provision is made for furnishing free water to charitable and public institutions, such as hospitals, schools, etc.?

7. Last, but probably the most important, is the ordinance which should accompany the special lien or mortgage bond, and which is to govern the rates in the event of a default on the part of the municipality, legal? The provisions of this ordinance as to consumer rates are important, but the hydrant rentals which are to be met as an operating cost of the municipality should provide the subsidy between what the consumer rates will produce and the service charge required in order to meet maturities and interest on the outstanding bonds. If this hydrant rental is flexible in the ordinance, and if it may be increased or decreased to meet any defaults in operating revenues from other consumers, then the mortgage or revenue bonds become in practice general obligation bonds to the extent that the hydrant rental is a general obligation of the municipality, payable out of operating revenue derived from a general property tax.

I should conclude, therefore, that the mortgage or revenue bond will probably increase in favor, as presenting a method by which many municipalities already over-bonded in general obligation bonds, may construct new plants or enlarge their present plants. Whether or not this is good practice will depend, as Mr. Taft has said, upon the particular project for which these mortgage or revenue bonds are issued. The success or failure of this type of financing from the viewpoint of both the municipality and the investor, is a problem of economic engineering rather than of law.

PREVENTING THE THEFT OF WATER

By C. M. McCord

(*General Superintendent, Water Department, Memphis, Tenn.*)

The Memphis Water Department has always taken a very generous and sympathetic attitude toward those customers who are in distress and unable to pay; and in discussing the theft of water, let it be understood that our interest is in that type of individual who can pay and will not. There are some who seem to take pride in stealing, and there are those so bold who in the past have stated to our employees that they expected to take all the water they wanted. Regardless of their particular reasons for this theft, a small number of such individuals scattered over the city certainly can be a nuisance, especially when the Department is not prepared to combat them.

In opposing this theft, one first turns to the law. We have prosecuted such offenders and convicted some of them. However, it is both difficult and expensive to gather positive evidence sufficient to convict. Furthermore, it is not the best advertising in the world to arrest a man for stealing a small amount of water. The public does not get the full circumstances, and if these were published, many would read the headlines only and complete the incident in their own mind and in their own way. There is still another feature about prosecuting that is worth considering. Should it happen that the Department prosecute one who could "make it appear" that he was without funds and destitute, the resulting publicity might be very harmful.

For those reasons, we decided to try to stop this theft without resorting to the law. In Memphis, we have about 25,000 rectangular meter boxes which have lids without locks and about the same number of round meter boxes which have lids with a lock of a kind. Most of these boxes carry both the stop cock and the meter. Anyone who desires to do so can remove these locked lids by using an improvised key. The gap made by removing the meter is usually closed by a nipple and the water turned on. Others connect up a hose, only when they want water.

We decided to approach the problem in two ways: first, by devising a pipe plug to be screwed into the stop cock which only our employees could remove, and second, by making a meter box lid with a lock that would keep them out of the box, or make their entry into the box a time-consuming problem.

The plug is made of steel and of such size as to make up well beyond the face of the stop cock. In the center, a half inch hole is drilled. The bottom of this half inch hole is squared by using an end mill, and then a half inch milling cutter, one-eighth inch thick, is passed to the bottom of the hole in the plug. The plug is then fed crossways for three-thirtyseconds of an inch. This results in a semi-circular undercut at the bottom of the half inch hole, varying in depth of cut from zero to a maximum of three-thirtyseconds. Part of the face and bore of the plug is covered by a steel section that is held in place by a circular spring wire. This part once snapped into position is not removable and rotates freely, independent of the plug. In other words, the turning of this part has no tendency toward screwing the plug either into or out of the stop cock.

The wrench for installing and removing this plug is made in two pieces, the outer end being a hexagon when the two pieces are placed together. The inner end, that is the end that fits into the plug, are half inch semi-circles, but one part has a projection on the extreme end of such size and shape as to fit into the undercut or recess made with the one-eighth inch milling cutter, as previously described. In using the wrench, the part with the projection on it is placed in position in the plug first and then the other half wrench is pushed into place. A conventional hexagon socket is placed over the two half hexagons, and in this way the plug is either screwed into or out of the stop cock. These plugs were made locally and case hardened. In a year of usage, many attempts have been made to take them out, but to date none have been removed except by our employees.

The meter box lock is a weight lock, the locking member being always held firmly in place by a weight lever and, therefore, is not affected by vibration. The thought given by us has been placed chiefly on the key and the key hole. We first made a key with two characteristics, namely: one that is hard to make—in fact, one that is very difficult to make; and second, one that requires a twisting, spiraling key hole that is difficult to pass anything through and, therefore, very difficult to accomplish something after navigating the circuitous route. It is apparent that we have given major attention

to the key hole, constructing a passageway that is difficult to pass any object through, whereas in most locks the key hole is usually a straightway opening, offering facilities for some form of picking tool. Should patience be rewarded and a picking member be made to pass through the spiraling opening in the lid, in order to actuate the lock it must continue through the opening and slide rotatively over the corrugated actuating member and move downward at the same time.

These spiraling key holes are made with slight taper and are smaller at the top so that any object accidentally passing into the key hole will continue through it.

Lids incorporating this lock have been placed on boxes from which water was being stolen, and so far they have not been opened except by our employees. As yet, we have treated these patients with only one or the other of the cures, but should it become necessary, we can treat an obstinate case with both of these corrective devices.

It is our expectation to institute another change shortly which likely will help us to know our customers better. This will be a perpetual contract which will reveal to the contract clerk, the type of individual with which he is dealing as revealed by his transactions with the Water Department.

It is not claimed that the mechanical devices as described have saved a great amount of money for the Department, but we do know they have created some paying accounts; but what is equally important is the satisfaction of having a means of preventing theft. Now when a customer calls in and relates that the man across the street is stealing water and the Department is making some pay while others help themselves and pay nothing, we can assure this customer that we will change the picture in thirty minutes, and being able to make this statement and being able to make the picture change has brought much satisfaction.

STUB BILLING

By T. G. Banks

(Superintendent and Engineer, Water Department, Oklahoma City, Okla.)

I am not an accountant and have not served any time in that phase of water works operations. Therefore, my comments must be from the standpoint of an observer or rather that of an executive comparing the merits of stub billing with other methods. Such a viewpoint is not without its advantage and therefore I do not hesitate to undertake this discussion.

Stub billing is a natural development of modern accounting in the direction of progress. I would compare the transition from the ledger system with the advance from the old bottle of copying ink and the letter press to the use of typewriter and carbon paper.

Any discussion of stub billing must necessarily be in comparison with other methods, or rather with ledger billing.

I will not say that there are not some conditions under which a ledger system is still adaptable or even preferable. The ledger system does not require the somewhat expensive outlay for equipment that the stub billing system requires and therefore the advisability of using the latter is limited to conditions where the volume of business justifies the outlay. Ledger billing has its advantages where a credit system or bureau is maintained, which makes it advantageous to have a customer's transactions recorded in a manner readily accessible. Where accounts are against the property, this argument is not applicable.

Probably in handling up to 1500 or 2000 accounts, ledger billing is more economical and to be preferred. The maximum number of accounts under which a ledger system can be economically employed would be somewhere between 5,000 and 10,000, although in my opinion, stub billing, even with manually operated equipment, is to be preferred with 5,000 accounts. Above 10,000 or more accounts to be handled monthly, stub billing is so much more satisfactory, can be handled more expeditiously with less force and so greatly increases

the efficiency of the personnel that the only excuse for not using it is the inertia or rather the lethargy due to following in a rut. This is especially true of municipally owned utilities where the governing bodies are so often composed of men not familiar with progressive large scale business methods. They are likely to listen to ill advised ignorant or willfully malicious persons to the extent that the handling of city affairs is kept from keeping pace with modern business methods. Even in Oklahoma City for several years after stub billing was adopted, one disgruntled, discharged employee succeeded in casting a shadow of doubt upon and a lack of confidence in the Water Department on the part of several councilmen. Only this party's flagrant unfitness which finally became obvious prevented serious interference.

Uptodate progressive private owned utilities would not adopt stub billing if it were not economical and efficient.

Foremost in the arguments for stub billing is the better and more efficient service to the public which it makes possible. Handling the cumbersome unwieldy ledgers, clerks interfering and waiting on each other while two or more have occasion to refer to the same ledger, is quite a contrast to the ease and dispatch with which any customers account is quickly located in the "tub" where stub billing is in use.

Next in importance is the efficiency in handling delinquent accounts. This advantage is not due so much to any inability to handle delinquent accounts satisfactorily with ledger billing, but to the fact that where ledger billing is used, the force is usually so badly behind with their work that delinquent accounts are not properly followed up, and are allowed to be neglected. With a stub billing system, at least in our own case at Oklahoma City, the same force handles a greatly increased number of accounts, is up with its work and we are able to give delinquent accounts the necessary attention. Probably this is partly the reason why we have reduced our delinquent accounts between $66\frac{2}{3}$ and 75 percent, in spite of economic conditions and why we are keeping our uncollectable items down to less than $\frac{1}{4}$ of 1 percent, of our gross earnings.

Last, but not least, is the better accounting possible. With the stub billing system the bookkeepers can readily give a balance and a monthly cash report within a day or at most two days after the close of the month. Under the ledger system we in Oklahoma City could not do this under 8 to 10 days.

There is no comparison between the ledger system with its lost

motion, double tracking, rechecking and double checking, going over accounts, adding delinquent amounts, etc. and a modern stub billing system with its orderly method of procedure.

In our Oklahoma City office we use an Addressograph Company's Graphotype stencil cutting machine, a Model 3720 motor driven Addressograph, which cuts, perforates, prints and addresses the bills out of bond paper which comes in 200 pound rolls, which we purchase at a cost of 0.093 cent per pound delivered. The billing is done on two Burroughs Model 2 Billing Machines.

The city is divided into 22 districts. This gives us approximately one district to bill per day for 5 days a week, making bills for different districts falling due, or to be distributed on different days. This distributes the work of the department continuously over the month.

There are a varying number of meter books for each district, with a total of 140 books for the city. We issue about 33,000 bills monthly. Our force consists of 27, including 4 meter readers, 2 bill delivery boys, 7 inspectors and delinquent bill collectors. Two and three clerks are constantly at the windows and two of the office force put in full time on handling delinquent bills.

No additional force is employed to offset the annual two weeks vacation with pay, and two weeks sick leave if necessary, to which employees are entitled with pay.

We are very well pleased with stub billing and would consider going back to ledger billing as much of a backward step as it would be to give up our city manager form of government.

STORAGE YARD AND MATERIAL HANDLING

By W. V. Weir

(*Superintendent, St. Louis County Water Company, University City, Mo.*)

In the last five years, more or less, the psychology of purchasing has changed greatly. From the housewife to the railroad practically all buying has been on a "hand to mouth" basis. Of the large industries the automobile manufacturers probably hold the record for the farthest swing to this new system of purchasing, while the waterworks industry has possibly done the least "hand to mouth" buying.

Our conservatism is due largely to the nature of the materials we use. Cast iron pipe has a conservative life of one to two hundred years. Waterworks brass goods are made to bury and forget. Lead and copper pipe are good indefinitely, depending upon the characteristics of the water supply. We think little of allowing these materials to lie in the storage yard, or in the warehouse for six months or a year, or five years in more than a few instances. In one yard I recently saw a number of fittings which had been in storage since 1886, 49 years.

What happens? The materials do not deteriorate usually. Interest on the value of these materials, however, continues at a rate several times higher than the annual depreciation of these materials when placed in actual service. If the physical portions of our distribution systems deteriorated at a rate of 4 to 6 percent yearly we would insist on better materials.

We should recognize that stock in storage costs money, not only to buy but to keep in storage. This is easily recognized if money has to be borrowed from a bank to keep materials in inventory. In every case the money is furnished by someone even though direct interest is not paid. In many water departments or companies the cutting out of unnecessary inventory will enable the hiring of from one to ten additional men. In keeping that pile of fittings in the yard for 49 years the interest cost at 4 percent compounded annually has been $583.30 for every $100 of original value in the pile.

A few years ago these remarks may not have been so pertinent. Then there was a normal drop in prices for off season delivery which made it worth while to stock up.

The implication is not to carry stocks so meagre that emergencies cannot be met. Stock on hand should allow new extension jobs to be started. The pipe companies are, however, able to get pipe to practically any part of this country before a sizeable job can be lined up, equipment moved, and a crew organized.

Some may think these remarks on interest, etc., more pertinent to a meeting of the "Finance and Accounting Division." The Superintendent, however, is the man who is responsible for the amount of materials in stock. If materials are requisitioned through a Purchasing Department, a reasonable coordination of these functions will enable a proper inventory to be kept in stock. A superintendent should be censured for keeping too much material in storage just as he is now condemned when he runs short on necessary items.

Not only is there a saving in interest when "hand to mouth" buying is practiced. It is no longer necessary to move pipe from the car to the stock pile and from the stock pile to the job. Handling from the car to the job always saves money.

In the past ten years in St. Louis County, Missouri, the St. Louis County Water Company has laid 317 miles of cast iron pipe, 6 to 36 inches in diameter. From 15 to 50 miles have been laid each year. The storage of pipe and fittings during this period has never exceeded a stock which could be orderly placed on a lot 60 feet by 150 feet in size. Approximately 90 percent of these 317 miles of pipe was handled from the car to the job without going into stock. Close attention to ordering pipe and excellent service from the pipe people allowed all jobs to proceed without interruption due to shortage of materials.

In handling materials into and out of the storage yard the first thing to be remembered is that an accurate accounting system must be set up and religiously followed. I will pass over this phase of stock handling with a reference to the excellent paper presented by Mr. J. S. Dunwoody of Erie, Pa. at the Chicago Convention and published in the December, 1933, Journal.

New materials may change the type of equipment needed for handling waterworks materials. The transite pipe people now persuade us that a car of 6-inch pipe can be unloaded in the same fashion used on a car of water melons. Heavier materials, however, will

continue to be used and equipment will be necessary for lifting heavy pipe out of cars to trucks or to storage piles.

Several switch tracks in addition to the one at the storage yard are often available in a large distribution system. A slightly longer unloading time will often more than offset a longer haul from a central storage yard switch. To enable our company to use these outlying switches we constructed, several years ago, a portable hand derrick which can be quickly set up and readily moved. About five minutes are required for two men to hang a platform on the side of a car, set up the derrick structure, hang the boom, and bind the complete outfit to the car with three chains and load binders. Each part of the outfit weighs less than 150 pounds. The car can be moved with the derrick left in position. One man can readily lift 12-inch 18 foot pipe or 16-inch 12 foot pipe, swing the pipe out of the car and lower it to the truck. This rig was developed after using gin poles for many years.

At our central switch we have a permanent I beam erected on which is hung a five ton electric hoist on a trolley. With this arrangement two men can unload 36-inch or smaller pipe, fittings and valves. One man can handle the entire job if necessary. The power bill for this hoist is less than $2.00 per month.

A few years ago we quit the practice of lifting small pipe out of the car one length at a time. A frame was built on which are four sets of hooks. We now handle four lengths of 6- or 8-inch pipe or two 12-inch pipe at a time with the electric hoist. This multiple hook frame speeds unloading considerably.

This discussion has covered only a few of the features of a topic to which probably every man here has given some time and study, certainly in regard to his particular problems of material storage and handling. Since considerable money is involved in this phase of operation of every water utility, a general discussion of different ideas, methods and equipment should be beneficial to most of us.

PAINTING, MARKINGS AND OTHER CHARACTERISTICS OF FIRE HYDRANTS

By Thomas L. Amiss

(Superintendent, Department of Water and Sewerage, Shreveport, La.)

In Memphis, Tennessee, in May 1932, I had the pleasure of reading a paper entitled, "Paint Markings on Fire Hydrants indicating flows available and other characteristics," before the members of the Plant Management Division of this Association.

That paper was the first of its kind on the subject and had little actual written information, other than volume, capacities and the like to work on. Consequently I had to formulate my own scheme of things and relate only possibilities as I visualized them from years of observation and study of water works operation.

However since that time I have had the pleasure of reading the very interesting discussion of George W. Booth, Chief Engineer of the National Board of Fire Underwriters—possibly one of the best informed men in this regard—entitled, "Method of Making Flow Tests and Their Value to Water Works Engineers," delivered before the Fire Protection Division of New York during one of their meetings, held May 20, 1924. The complete article appeared in The Journal of October, 1924, Vol. 12, No. 2; also the paper of P. S. Wilson entitled, "Hydrant Discharge Measurements and Their Value to Water Works Operators," which appeared in The Journal of July, 1930, Vol. 22, No. 7. Both of these papers give valuable data for conducting a hydrant flow survey and the benefits derived therefrom. However, no thought was expressed to color the hydrants or mark thereon a sign characterizing the volume or capacity of the individual hydrant or group of hydrants as the case may be.

As I studied the results of my own survey, which will be analyzed later, and those of the above named gentlemen and also the records of several flow tests made by the engineers of the National Board of Fire Underwriters in their surveys of the City of Shreveport from 1911 to the present time, and on which survey I had the pleasure of being present, representing the Water Company and later the City of Shreveport, many important possibilities presented themselves to me.

Since fire hydrants are primarily a fire protection feature of the water works system and are used almost exclusively by the City firemen, few of whom know anything about the principles involved in water works operation, I felt that the major thoughts in this objective concern them. I am not unmindful however of the fact that, whatever is of benefit to the fireman is also of beneficial help to our employee in the distribution service. The closest coöperation of the two services is encouraged.

First then the question of being able to locate the fire hydrants quickly presents itself and as darkness has much to do in that respect, the color which offered the greatest visability at night is the color to be used. The old conventional fire hydrant Red, hardly visible at night, which has served for over a hundred years gives way to the color that experts say penetrates further into the darkness, "Chrome Yellow." Now that this color is being used and is admitted by many to be seen at a greater distance seems to me settles the question of uniform color. I have had nothing but favorable comments from the public on this score. Therefore, yellow is not offensive. Having satisfied those who are called upon to use these hydrants in all kinds of weather and under varied conditions as to the color, the next step in our advance in this work is to consider the capacity or volume of the hydrant which we have helped to locate quickly. The one and only out-standing marking or sign to make this characteristic most prominent in my opinion is to designate them through colors and bear in mind, these colors must be such that the engine man whose duty it is to make the most efficient hook-up are capable of being distinguished from a block away. In other words traveling at 25 miles per hour one should be able to discern the marking or color giving him full knowledge as to capacity of the hydrant as he approaches it and whether or not it will serve the pumper in his charge. Likewise this same outstanding character can serve as a guide as to whether or not a pumper is necessary. We must further appreciate the fact that fire hydrants are usually operated in haste and in an emergency. Therefore, whatever is indicated should be prominent.

Before I settled on any definite colors I looked around for data on the subject and found that the Committee's Report on Uniform Marking of Fire Hydrants, dated March 14, 1934 recommended, Quote:

(a) That hydrants be classified as follows:

Class A—Flow capacity of 1,000 g.p.m. or greater

Class B—Flow capacity of 500–1,000 g.p.m.
Class C—Flow capacity of less than 500 g.p.m.

Capacities to be rated by pitometer tests of individual hydrants at periods of ordinary demand. Rating to be based on 20 pounds per square inch residual pressure when initial pressures are over 40 pounds per square inch. When initial pressures are less than 40 pounds per square inch, residual pressures shall be at least half of the initial.

(b) That the following capacities indicating color scheme be adopted as providing simplicity and consistency with colors used in signal work for safety, danger and intermediate condition:

Public Hydrants

All barrels to be chrome yellow, *except in cases where another color has already been adopted.*

Class A—Tops and nozzles caps—Green
Class B—Tops and nozzles caps—Orange
Class C—Tops and nozzles caps—Red

Private Hydrants

Within private inclosures, the marking to be at the discretion of the owners. When in public streets, they should be painted entirely red to distinguish them from public hydrants.

(c) That all location markers for flush hydrants should carry the same color background as stated above for class indications, etc.

(d) That the colors should be understood to signify only the individual capacity of the hydrant as tested and not group hydrant effect.

In commenting on the above report I wish it distinctly understood that my criticisms are for the sole purpose of placing this subject matter directly before you for your consideration and discussion and not with the thought of questioning the report of the committee.

We agree that the idea of indicating relative available fire service draft of hydrants by different colors is of substantial value to water and fire departments. We agree also as to the relative values of individual and group tests. On flow capacities we disagree slightly. On the large flow we agree that 1,000 gpm and over be indicated as the efficient hydrant. As to the different colors we disagree, the committee calls for an all yellow hydrant with green top and nozzle caps for Class A hydrant. The 1,000 gpm or over hydrant should be of uniform solid color with no contrast color to indicate the volume or capacity, as it is your best bet and easily seen. The deficient hydrant or exception should be represented by color contrast and these color contrasts to vary with the degree of deficiency. The Class B hydrant of the committee is rated at 500 to 1,000 gpm and carries a color scheme of a yellow barrel with an orange top and caps, which in my opinion is wrong as it will show solid yellow at night and therefore no difference. This hydrant corresponds to my 750 gpm as a second

best hydrant indicated in my set-up by a soft tone of brown made up of 50 percent yellow and seal brown. The Committee's red top hydrant representing their worst flow hydrant will in actual operation at night be hard to differentiate from their best hydrant with the green top and will cause confusion. Unlike my set-up of red and green for the low flow hydrants cannot be mistaken for a high flow hydrant at any time.

I fully appreciate the value of signal colors for safety, danger and intermediate condition and at first thought it appealed to me until I found that safety *green* and danger *red* were so much alike at night. The use of contrasting colors for indicating the low or dangerous flows is, therefore, unwise.

This division of the A. W. W. A. should go on record as adopting some uniform color scheme for hydrants throughout, without exceptions and those desiring to standardize can easily comply with no additional cost, as hydrants should be painted within three year intervals for proper maintenance, to say nothing of appearance.

As to private hydrants in private inclosures, the marking, painting and the like should be left to the discretion of the owners, since the City has no jurisdiction in private property other than the privilege of inspection.

Private hydrants on public streets is another question. They are there solely for public use in emergency and therefore should come under the head of public hydrant and should conform to the standard.

All location markers for flush hydrants should carry the same color ground as is finally adopted for the hydrants, as the flush hydrant serves the same purpose as the regular hydrant.

Bearing on the subject of volume or capacity, the hydrant flow should be based on group rating according the general accepted rating for efficient fire protection, rather than individual rating, because the static pressure on a system composed of small pipes will suffer materially if group hydrants are used simultaneously and it is at this time that the volume or capacity should be known. Any other time it is immaterial. It was because of this fact that the following methods were used in Shreveport.

METHODS AND DETAILS OF SURVEY CONDUCTED IN SHREVEPORT IN 1932

Mr. E. H. Cranmer, my resident engineer, conducted the flow survey and after we carefully studied our map of the distribution system we planned 155 tests classified in three groups, mercantile or

business section, semi-business section and residential. In the first group we decided to flow 4,000 gpm from 4 hydrants, recording the static and residual pressure from a hydrant within the group identified as A, the flow of the others B, C, D and E. These identification letters were used throughout the survey dropping the last letters as we reduced the number of flows in the less valued districts. Four thousand gallons per minute is equivalent to 4 of our largest pumpers and 16 fire streams discharging 250 gpm or a rate of 5,760,000 g.p.d. This flow is capable of meeting almost any emergency confronting a city of 100,000 population.

In the second group 2,250 gpm were used flowing from 3 hydrants. This is one half of the minimum of 1500 gpm and the maximum of 3000 gpm as suggested by the National Board of Fire Underwriters required flow for this classification risk, and is equivalent to a little over 8 fire streams discharging 250 gpm each.

The third group, "residential," where the flow depends upon the character and congestion of the buildings and because the spacing of the hydrants are of somewhat greater distance apart, used 3 flowing 500 gpm hydrants and especially recorded those hydrants flowing 300 gpm under these conditions.

A key map of the City's distribution system was made identifying each test by number, the static point by the letter A with street location and each of the flow points by the letter B, C, D and E, also giving the hydrant location by street or otherwise.

Of the 155 tests, 13 were made in the mercantile section involving 60 hydrants; 30 in the semi-business district using 119 hydrants and in the residential section 112 tests were made, of which 98 groups of 3 hydrants were used and 14 groups of 2 hydrants each, involving a total of 312 hydrants, these forming the nucleus of our survey.

The average static pressure found in the first class was 85.5 pounds, the residual 68.5, or an average pressure drop of 17 pounds. In the second class, 73.1 and 42.5 pounds, and in the third or residential class, 68.6 and 43.0 pounds, with a pressure drop of 30.6 and 25.6, respectively.

The true hydraulic plane in average pressure for the first group is 93.66 pounds compared with 85.5 the actual average. In the second group 84.08 compared with 73.1 and in the third 68.6 as compared with 43. However, the average pressures as recorded as static should be termed daily residual in as much as the static pressures in the tests were taken during the daily pumpage, which fact would naturally

be reflected in a reduction of static due to friction. You will note however in the first instance a difference of only 8.1 pounds, in the second 10.9 pounds and in the third 25.6. The greatest loss is sustained in the third group or residential as you move away from the plant. Shreveport has an area of over 19 square miles and a system in the City proper of 8 miles in length, 4 miles in width, which means a healthy gridiron system to meet requirements.

The flow pitot gauge was used, adding 5 percent to the flow for variations. There was little difference in the pressure recorded by the hydrant pitot and that of the guage connected to the opposite hose nozzle.

IS A RECORD SYSTEM OF UNDERGROUND WATER MAINS JUSTIFIABLE?

By E. A. Munyan

(Consulting Engineer and Attorney at Law; Manager, Gas and Water Departments, Union Gas and Electric Company, Cincinnati, O., Union Light, Heat and Power Company, Covington, Ky.)

One of the most important matters in the operation of any utility, whether a water utility or otherwise, is to know just what your utility property consists of, how many miles of main you have, where the valves and water services are located, and how many you have. Underground water mains and services make up the greatest amount of capital invested in the water system, except for that invested in water towers, reservoirs, and pumping stations. In some cities the capital invested in the main lines and services is even greater than that for reservoirs and pumping stations. This paper will, however, deal only with the matter of underground structures, particularly describing the system of records used by our particular companies.

The first matter to consider in making a record of a water system is that of the general layout of the mains in relation to the streets and roads involved in the territory. The best way to do this, in the opinion of the writer, is to make up a map to some certain scale, or to sectionalize some map previously produced by some professional map maker. This latter is quite often the logical step, as professional map makers have the opportunity of keeping street names, building changes, etc., up to date more readily than the water utility which would make changes only as necessity demanded.

Figure 1 shows a sectional layout of streets and highways in the City of Ft. Thomas, Kentucky, which is served with water by one of our associated properties, namely the Union Light, Heat and Power Company, and this layout is only one of a number of charts used for the entire system. It can be seen that the scale used is 200 feet to the inch, and the streets on the map are wide enough for us to locate the water mains, valves, fire plugs, etc., on the proper side of the

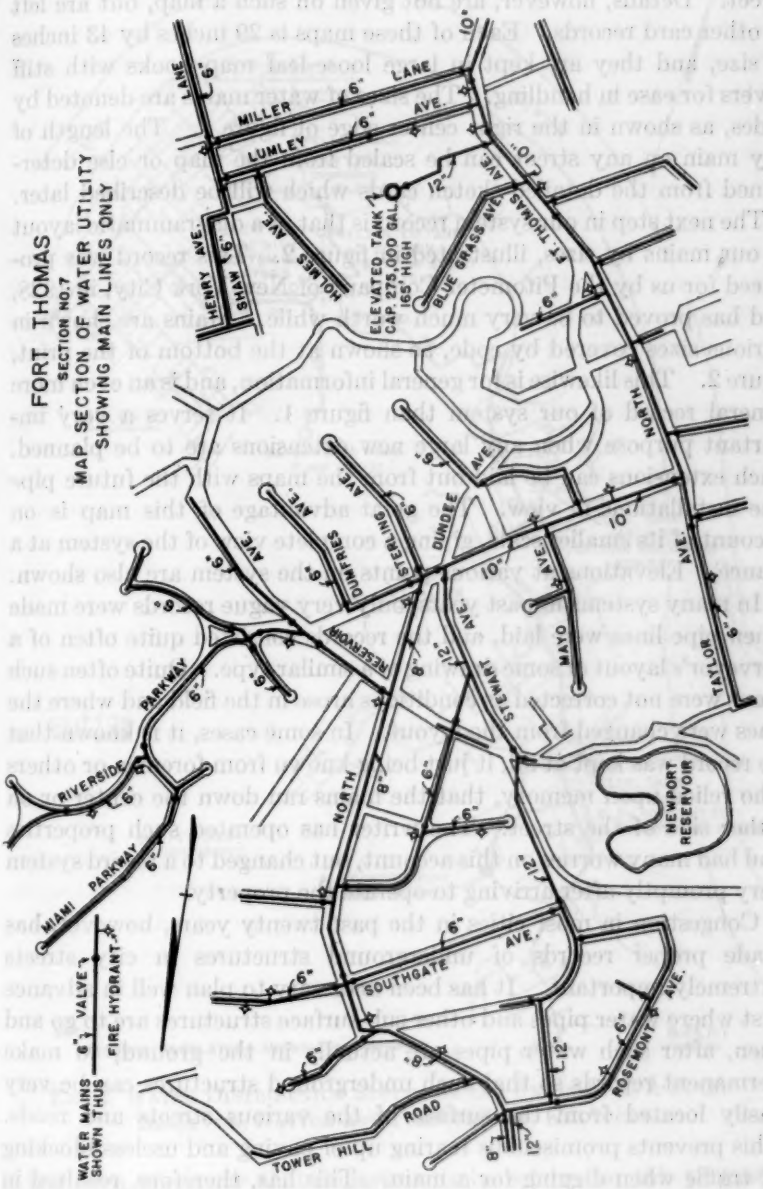
FORT THOMAS
SECTION NO.7
MAP SECTION OF WATER UTILITY
SHOWING MAIN LINES ONLY
WATER MAINS SHOWN THUS
6" VALVE
FIRE HYDRANT
LANE
MILLER
LUMLEY
AVE.
HENRY AVE.
SHAW
HOLMES AVE.
ELEVATED TANK
CAP. 275,000 GAL.
165' HIGH
BLUE GRASS AVE.
FT. THOMAS
NORTH
DUNDEE
STERLING
QUIMPRIES
RESERVOIR
MAYO
TAYLOR
STEWART
PARKWAY
RIVERSIDE
MIAMI
NEWPORT
RESERVOIR
SOUTHGATE
ROSEMONT
TOWER HILL
ROAD

FIG. 1

street. Details, however, are not given on such a map, but are left to other card records. Each of these maps is 29 inches by 43 inches in size, and they are kept in large loose-leaf map books with stiff covers for ease in handling. The sizes of water mains are denoted by codes, as shown in the right center edge of figure 1. The length of any main on any street can be scaled from the map or else determined from the detailed sketch cards which will be described later.

The next step in our system record is that of a diagrammatic layout of our mains by sizes, illustrated in figure 2. This record was produced for us by the Pitometer Company of New York City, in 1928, and has proved to be very much worth while. Mains are shown in various sizes covered by code, as shown at the bottom of the print, figure 2. This likewise is for general information, and is an even more general record of our system than figure 1. It serves a very important purpose when any large new extensions are to be planned. Such extensions can be laid out from the maps with the future pipe line installations in view. The great advantage of this map is on account of its smaller scale, giving a complete view of the system at a glance. Elevations at various points on the system are also shown.

In many systems in past years, only very vague records were made when pipe lines were laid, and the records consisted quite often of a surveyor's layout or some drawing of a similar type. Quite often such plans were not corrected as conditions arose in the field and where the lines were changed from the layout. In some cases, it is known that no record was kept at all, it just being known from foremen or others who relied upon memory, that the mains ran down the center or on either side of the street. The writer has operated such properties and had many worries on this account, but changed to a record system very promptly after arriving to operate the property.

Congestion in most cities in the past twenty years, however, has made proper records of underground structures in city streets extremely important. It has been necessary to plan well in advance just where water pipes and other sub-surface structures are to go and then, after such water pipes are actually in the ground, to make permanent records so that such underground structures can be very easily located from the surface of the various streets and roads. This prevents promiscuous tearing up of paving and useless blocking of traffic when digging for a main. This has, therefore, resulted in many utility systems, whether they be water, sewer, gas, electric, or telephone, keeping very accurate record systems, and in some cases

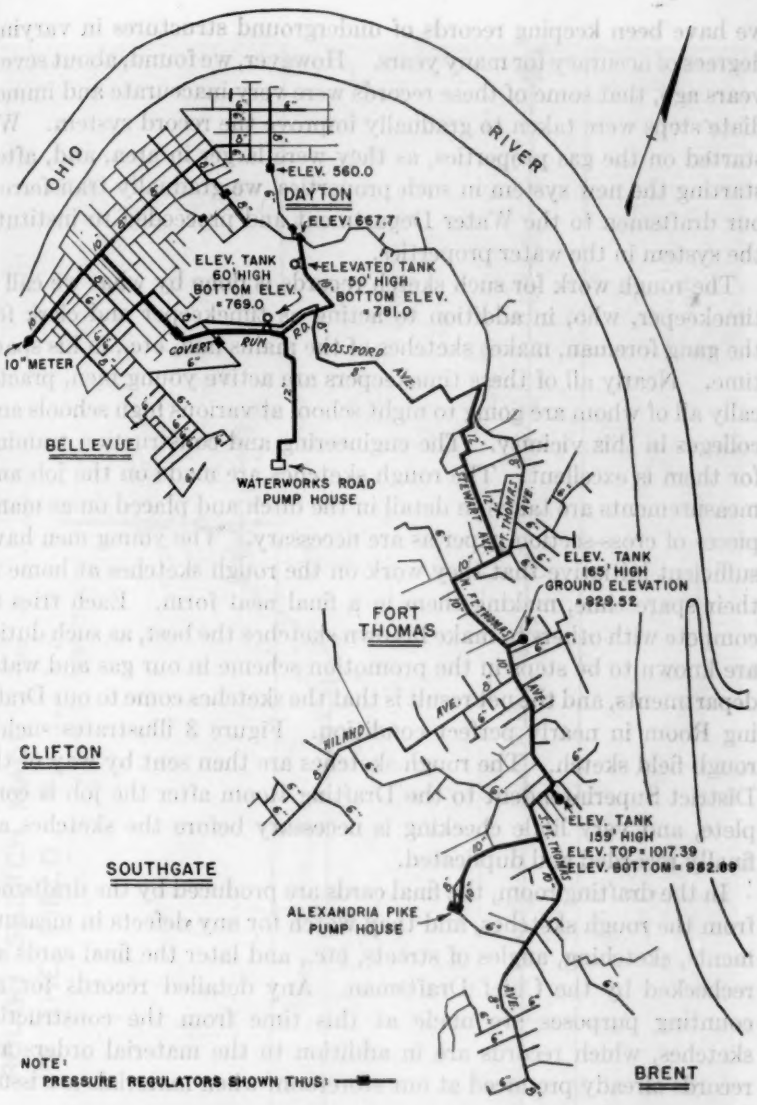

FIG. 2. WATER DISTRIBUTION SYSTEM OF THE UNION L. H. & P. CO. BELLEVUE, DAYTON AND FORT THOMAS, KENTUCKY

it has been necessary that departments be set up for this purpose, particularly in the larger systems.

In our particular properties, in both the water and gas divisions,

we have been keeping records of underground structures in varying degrees of accuracy for many years. However, we found, about seven years ago, that some of these records were very inaccurate and immediate steps were taken to gradually improve the record system. We started on the gas properties, as they were larger in area, and, after starting the new system in such properties, we gradually transferred our draftsmen to the Water Department and proceeded to institute the system in the water properties.

The rough work for such sketch records is done by what we call a timekeeper, who, in addition to acting as timekeeper and clerk for the gang foreman, makes sketches of the mains laid, etc., in his spare time. Nearly all of these timekeepers are active young men, practically all of whom are going to night school at various high schools and colleges in this vicinity. The engineering and construction training for them is excellent. The rough sketches are made on the job and measurements are taken in detail in the ditch and placed on as many pieces of cross-section paper as are necessary. The young men have sufficient initiative that they work on the rough sketches at home in their spare time, making them in a final neat form. Each tries to compete with others to make his own sketches the best, as such duties are known to be steps in the promotion scheme in our gas and water departments, and the net result is that the sketches come to our Drafting Room in nearly perfect condition. Figure 3 illustrates such a rough field sketch. The rough sketches are then sent by way of the District Superintendent to the Drafting Room after the job is complete, and very little checking is necessary before the sketches are finally recorded and duplicated.

In the drafting room, the final cards are produced by the draftsmen from the rough sketches, and they watch for any defects in measurements, sketching, angles of streets, etc., and later the final cards are rechecked by the Chief Draftsman. Any detailed records for accounting purposes are made at this time from the construction sketches, which records are in addition to the material orders and records already produced at our storeroom when materials are issued for construction purposes.

Under our plan of finally recording construction work in the Drafting Room, we start out with one card called the "Number 1 Card," shown on the left in figure 4, on which there is space for a title and sufficient space for a small sketch. The reverse side of this card is shown in the center in figure 4. We have different colors and codes

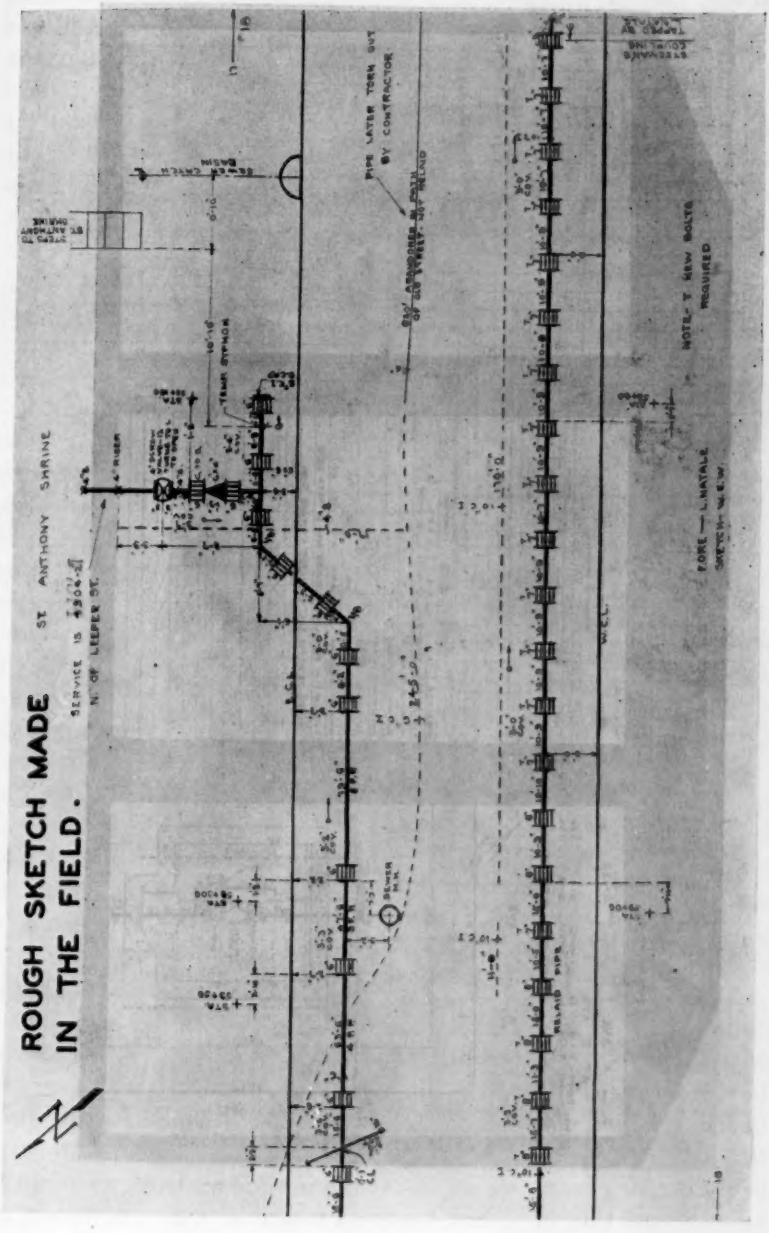
ROUGH SKETCH MADE
IN THE FIELD.
ST ANTHONY SHRINE
PIPE LAYER TORN OUT
BY CONTRACTOR
NOTE- 7 NEW BOLTS
REQUIRED

FIG. 3

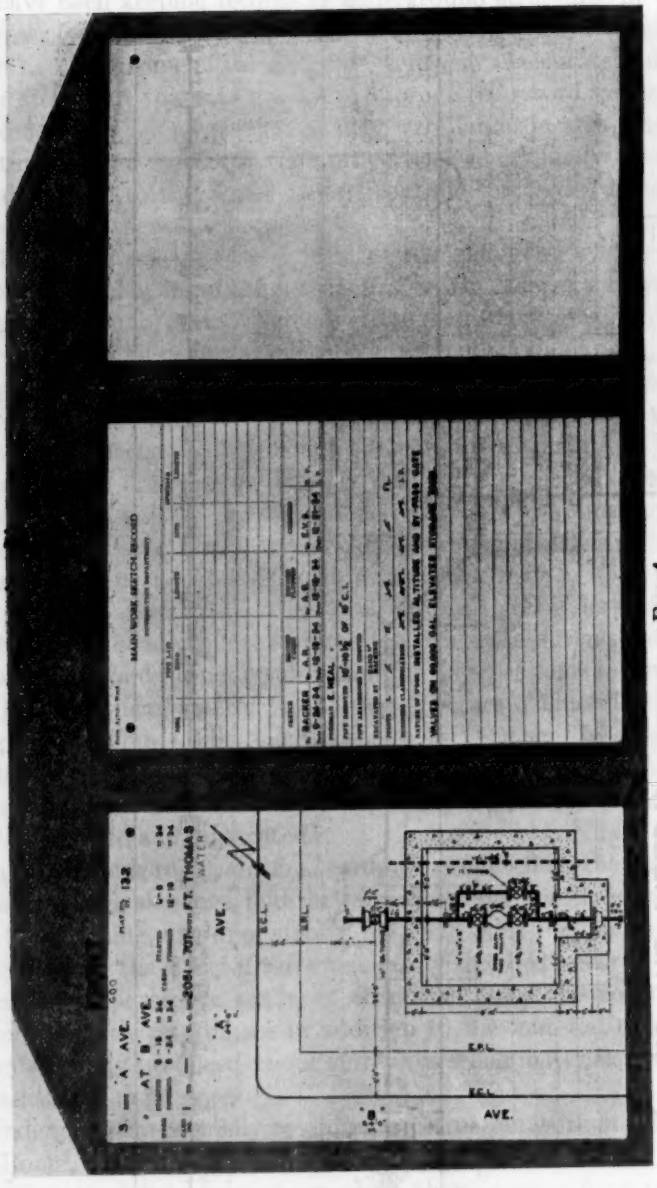

FIG. 4

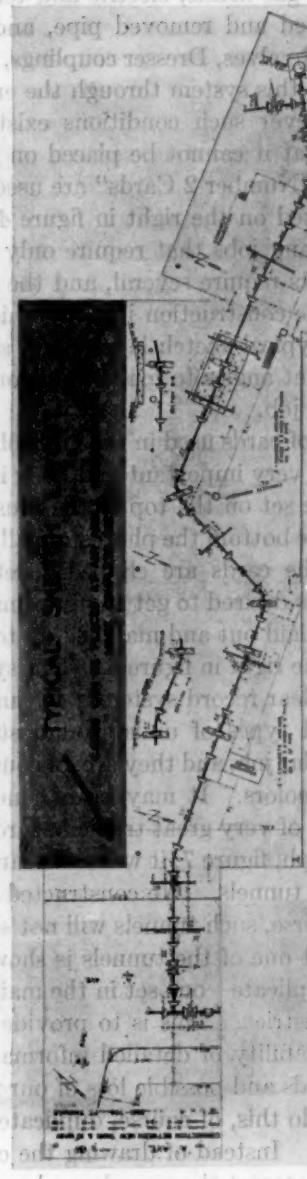

FIG. 5

for new and old water and gas mains, electric and telephone ducts, sewers, manholes, abandoned and removed pipe, and for bell and spigot pipe, hub and flanged valves, Dresser couplings, split and solid sleeves, etc., and just carry this system through the entire record of the construction job wherever such conditions exist. Where the sketch record is so large that it cannot be placed on one card, any number of what are called "Number 2 Cards" are used as are necessary. This card is illustrated on the right in figure 4. Its reverse side is blank. We have many jobs that require only one card, but the vast majority of projects require several, and the largest sketch record involved a seven mile construction job, for which we used 85 cards. Figure 5 shows a typical sketch layout and shows how the cards may be laid at different angles to make up a complete picture of the construction or repair job.

Figure 6 also shows a set of cards used in the multiple card system, and describes the work at a very important and busy intersection on one of our properties. The set on the top of the illustration shows the original cards, and on the bottom the photostatically copied cards for our duplicate files. The cards are clipped together for filing purposes, and then when it is desired to get any information from the sketch record the cards are laid out and matched up to make a complete picture, as shown at the right in figure 6. This system makes a very handy and still very clear record system. It can be seen from figure 6 that all kinds and types of underground structures were encountered on that particular job, and they are, of course, illustrated by the various codes and colors. It may be of general interest to know, also, that on account of very great traffic hazards at this location, shown in the photograph, figure 7, it was necessary to construct some of these lines through tunnels. We constructed and used four tunnels on this job. Of course, such tunnels will not show on a plan sketch, such as figure 6, but one of the tunnels is shown in figure 8.

All records are kept in duplicate—one set in the main office, and a duplicate set in the local district. This is to provide means in the district for immediate availability of detailed information, and also to protect against fire hazards and possible loss of our records at one or the other location. To do this, of course, duplicate records must be made from the originals. Instead of drawing the cards up again in the drafting room, we photostat the records we have, as shown in figure 6, and this, of course, produces a card with a white record on dark brown colored paper. We then place the necessary colors, with

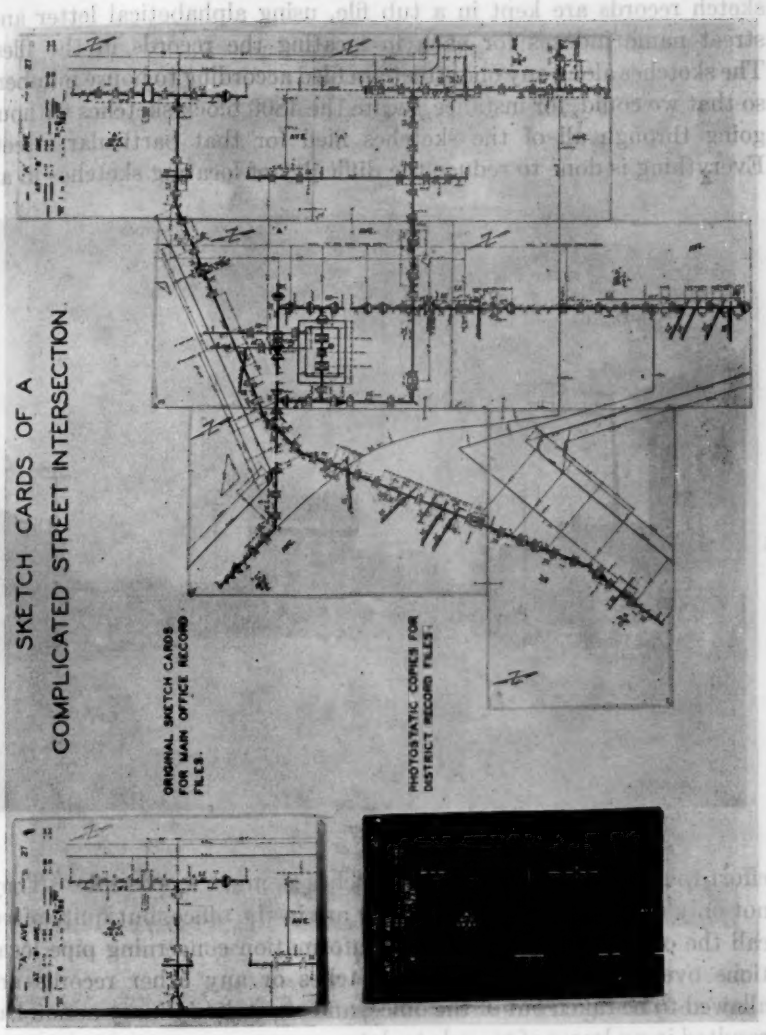
SKETCH CARDS OF A
COMPLICATED STREET INTERSECTION
ORIGINAL SKETCH CARDS FOR MAIN OFFICE RECORD FILES.
PHOTOSTATIC COPIES FOR DISTRICT RECORD FILES.

FIG. 6

ink, over the white lines on the brown photostat and we then have a duplicate of the original, even down to the color details. This photostatic copy is then sent to the district for filing, and all such sketch records are kept in a tub file, using alphabetical letter and street name indexes for each in locating the records in the files. The sketches along any one street are filed according to house numbers so that we could, for instance, locate the 4800 block sketches without going through all of the sketches filed for that particular street. Everything is done to reduce the difficulty of locating sketches in an

FIG. 7

effort to get our men to use the sketches as much as possible. They not only use the sketches when they are in the office, but quite often call the office and obtain detailed information concerning pipe locations over the telephone. No sketches or any other records are allowed to be taken out of the office, and strict disciplinary action has resulted in no losses of records to date.

As new construction is completed or changes are made in our pipe systems, our general maps are changed as necessary so that they also may be kept up to date. This is a function of the chief draftsman, and is his responsibility and that of his men. We have made efforts

in the past to rotate our timekeepers from job to job, and every so often bring them into the Drafting Room for periods of duty to bring them up to date as to any changes of system that might occur from

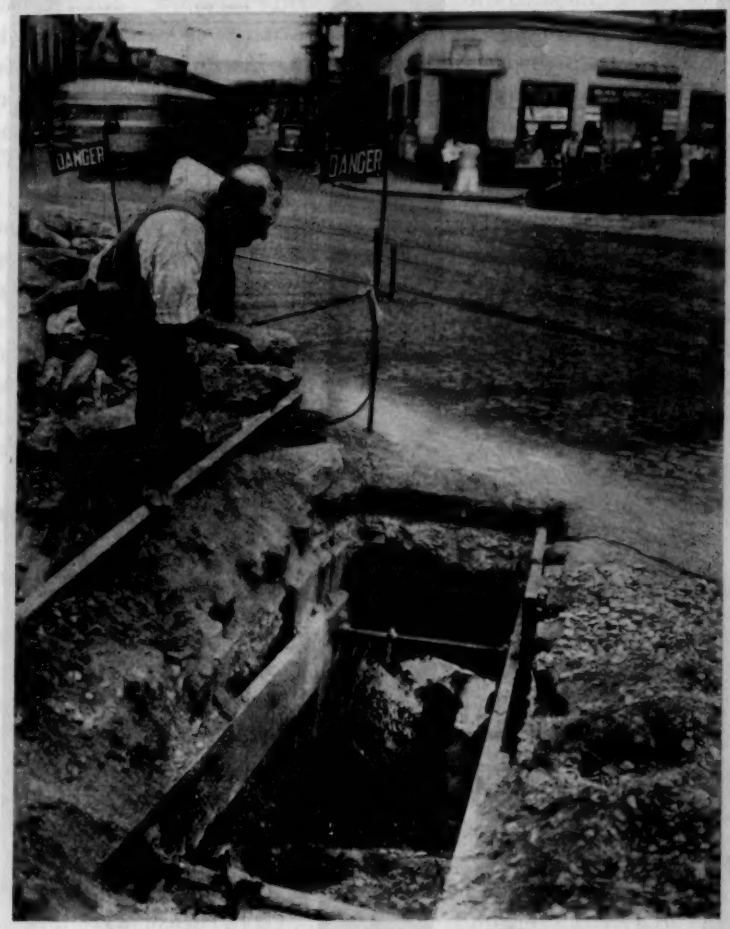

FIG. 8

time to time. It also prevents them from going stale on their particular jobs.

When any new valves are installed, or if previously installed and no records have been made out for them, we make up a Valve Record Card, as shown at the top in figure 9. This record, as can be seen, gives us definite location, size of valves, type, number of turns to open,

VALVE RECORD
No. 970
LOCATION N. FT. THOMAS AVE. FT. THOMAS
NEAREST HOUSE NO. 119 N. FT. THOMAS AVE.
DATE INSTALLED 10-5-11 84. DATE LOCATED
LOCATION 28 FEET 7 INS. E. OF W'C LINE OF N. FT. THOMAS
487 FEET 3 INS. S. OF S'C. LINE OF FOREST
SIZE 12" DEPTH TO TOP 4 FEET 8 INS.
STYLE OF VALVE HUB REQUIRES 25½ TURNS TO C TO OPEN
REMARKS WATER DEPT.
SIGNED ROGERS
W SIDE OF N FT THOMAS
FOREST
CURB LINE
PROPERTY LINE
HIGHLAND
N FT THOMAS
W SIDE OF ALEXANDRIA PK
ALEXANDRIA
CROWELL
PK
NEAREST HOUSE No. 1523 ALEXANDRIA PIKE
NAME ST. STEPHEN CEMETERY
CAMPBELL CO.
W. S. No. 26356
SERVICE
INSTALLED MAIN COCK 29 FT.
SIZE OF SERVICE 4"
SIZE OF MAIN 6"
PERMIT NO.
STREET CUTS
TYPE OF PAVING CONC.
BASE
DATE 4-8-33
FOREMAN NEAL
WATER DEPT.

FIG. 9

etc., and on the reverse side of the card we have a place for a sketch, which is filled out with proper dimensions and data so that complete information is on file in the office at all times. Duplicates are kept in the districts. Space is provided for a record of opening and closing of the valves. This is particularly necessary on our water properties where we have to produce more or less false heads by valving off the low spots and re-routing water from the regulators so that proper head may be maintained on the hills and valleys in our territory. This record has proved of value many times.

We also keep a record of our service installations. In our properties, we run the service pipe from the main to the curb, and for each service we prepare a Service Card Record as shown at the bottom of figure 9. This also gives complete location, size, etc., and acts as a paving record. On the reverse side we have diagrams for sketching purposes and the timekeeper produces a sketch using the diagram as a basis, and we can thereby go to the job and immediately locate the service, curb cock, etc., without any digging necessary. Duplicate cards are also kept in the districts.

In conclusion, in the writer's opinion, based on twenty-five years' practical and technical experience, each and every water system, whether it be of a private or public nature, can very well afford to make necessary expenditures, not only for the installation of a proper record system of its underground properties, but should also be very glad to include in its budget the proper operating amounts to keep such a system up to date at all times. In our system we have reason to believe that we can and insist upon being able to locate all such mains and services within one inch variation where the new system has been installed, and this saves us thousands of dollars yearly on digging and paving expenses, particularly on maintenance work, or where water main cleaning is being done.

The saving to our consumers in lessening of delays when breaks in mains or other troubles occur cannot be calculated in dollars and cents, but is of great value in keeping our consumers satisfied with the better service they obtain through the proper operation of such record systems. This same feature applies to municipally operated plants.

PROGRESS IN DAMS AND PIPE LINES

By Thomas H. Wiggin

(Consulting Engineer, New York, N. Y.)

As chairman of the Water Supply Engineering Committee of the Sanitary Engineering Division, American Society of Civil Engineers, the speaker has presented three annual reports to that Society covering progress in Water Supply in its various branches, and feels apologetic because of being unable to add anything new in his report to this Association. The American Water Works Association in inaugurating similar reports for itself this year has wisely divided the field among several speakers and the present speaker has been assigned dams and pipe lines. There is some overlapping since distribution which is largely pipe lines has been included in the assignment of Mr. Brush and pipe lines are included also in the speaker's assignment. Probably a difference in point of view will prevent real interference, and as pipe lines constitute more than half of waterworks they are worthy of double attention.

The wording of the subject appears to confine the scope of the statements to progress during the year, meaning one would suppose, progress since May of 1934. Practically, no fixed period can be taken since progress is generally of slow growth and consists in the gradual adoption of improved designs or methods so that it may be observed best by a comparison extending over a decade or more rather than only a 12-month. It is generally impossible even for a thorough student of current literature—which the speaker is not—to detect when a new method becomes so well proved that it may be surely called progress and not merely novelty.

DAMS

The past 12-month has witnessed the substantial completion of the mighty Boulder Dam on the Colorado River. This dam has a section designed for stability by gravity and is at the same time built in the form of an arch of relatively sharp radius, 500 feet, but it is so high—732 feet—as to entail special problems in masonry stress. The design has been sharply criticized and stoutly defended, but it

has not yet been filled, hence notes as to progress in the art illustrated by this dam may properly be confined to certain details of construction. The most outstanding of these is the use of special low-heat cement and particularly the further reduction in temperature with exact control of it by the use of a complete system of 1-inch steel refrigerating pipes imbedded throughout the dam at a spacing of about 5 feet 9 inches. Approximately 1 foot of pipe was used per cubic yard of concrete. A three-unit refrigerating plant having a total capacity of 600 tons of ice per day and a cooling tower of a rated capacity of 6000 g.p.m. were used.

It may now be recorded that the concrete was in fact cooled to the desired temperature and that the construction joints which had been left according to a definite plan were grouted as intended so as to apparently bring the whole structure into bearing. Copper expansion joints were used in dividing the masonry into sections for grouting.

It should be stated that, while low-heat, slow-setting cement used in the Boulder Dam and similar cement specified and furnished under exceptionally careful control at Pine Canyon Dam of the Pasadena, California, Water Works is highly suitable for heavy sections like dams, quick-setting, high-heat cement is more suitable for highways and the progress in this respect consists in specifying and being able to obtain the right cement for the work in hand.

At Boulder Dam, which has furnished examples of excessive size and speed in many particulars, were built the largest and heaviest welded pipes on record, viz., 30 feet in diameter and $2\frac{3}{4}$ inches thick.

What appears to be progress in the economic and satisfactory placing of concrete in dams is illustrated by the use of the so-called Pumpcrete in depositing concrete in the Bills Brook dam of the Hartford, Connecticut, Metropolitan District Water Supply, in Dam No. 5 of the Upper Mississippi River, and elsewhere. What is in effect a duplex, single-action plunger pump having a bore of $7\frac{1}{2}$ inches, a stroke of 12 inches and a speed of 50 strokes per minute, delivers concrete through a 7-inch pipe to distances up to 1000 feet at a rate of 50 cubic yards per hour. In cold weather pipes may be insulated to keep the concrete warm.

Another distinct advance in placing concrete in dams and elsewhere is in the use of vibrators, particularly those used in the mass which are a comparatively new development as compared with those attached to forms.

An unusual and seemingly a very valuable and progressive application of the pneumatic caisson was recently (1933) exemplified at the Quabbin Reservoir dam of the Massachusetts Metropolitan District Supply. Thirty rectangular caissons each 45 feet long, 9 feet wide and generally over 100 feet deep were sunk end to end and sealed into rock to form the deep part of the core for this earth dam which has a maximum height of about 140 feet above the original ground surface and about 130 feet maximum depth of core below ground surface to rock. A secure cut-off to rock has been obtained in a very deep wet overlying material. A similar effect was obtained a decade or so ago at Wanaque dam in New Jersey by driving two rows of steel sheet piles to a maximum depth of about 90 feet, excavating a trench between and building a concrete core wall about 8 feet wide from the rock to the surface and thence up to the top of the dam.

Lack of space prevents more than passing mention of the progress continuing during the past decade or more in selection of material for earth dams, in control of moisture while compacting, in compacting, and in control of compacting by measurement of the densities attained. The most elaborate application of these methods was that in three earth dams of the Los Angeles supply, where seemingly new principles were enunciated following the lines of study of Dr. Charles Terzaghi. Such studies have probably increased safety with some increase in cost since the sections of dam remain of the usual degree of conservatism.

An example of a high dam constructed on pervious glacial material is the Hardy Dam in Michigan. The article by E. M. Bard, Engineer, in the A. S. C. E. Transactions for 1934, with discussions, develops and clarifies the principles of design of the economical Michigan type of dam with thin core wall and cut-off ending in porous material.

A lesson in supposed need of flushing a rock fill dam during construction to cause proper settlement and avoid after-movement which will destroy the watertight upstream face is afforded by San Gabriel, California, Rockfill Dam No. 2, 265 feet high, now under repair after settlement. Those who are familiar with the settlement of rockfill in certain stretches of the old Croton Aqueduct built in about the middle of the last century, but repaired in part in recent years may wonder if proper flushing would have prevented that damage which has greatly diminished the usefulness of that Aqueduct.

A similar lesson, now several years old, may be noted in the case of

the Lafayette earth dam of the East Bay Municipal District, California. This dam, about 100 feet high, and of generous section, slumped when the reservoir was first only in small part filled, and overloading of its earth foundation was the cause found. This was to most dam builders a new possibility. It has been added to the conditions to be considered in the design of earth dams.

Though lack of progress was not a part of the speaker's assignment he wishes to take the liberty of including an occasional reference of that kind. The design of gravity masonry dams is still in an uncertain state as regards provisions for uplift pressure and for ice pressure in cold climates. Modern large gravity dams are almost invariably built with provisions for uplift and in cold climates for ice pressure. A myriad of older dams exist however without such provisions. Occasional but very infrequent failures occur. The engineering profession should seriously consider clarifying this subject and laying down principles for new dams and for judging the safety of existing dams. Continued study on this question is evidenced by many excellent papers and discussions before technical societies, but a judicial appraisal of the results by recognized engineering authority would be useful, even if it is admittedly subject to modification as increased knowledge is gained.

Spillways also continue to be a moot point, and spillways of many old dams and some new ones are of doubtful safety. Nature generally has occurrences more extreme than have been witnessed by recent generations. It is hard to escape the conclusion that nearly all earth dams are doomed to ultimate washing out by larger storms. Collection of flood data has lagged for lack of funds, but has now been resumed by the A. S. C. E. Too much attention has been paid to computed peak flood flows and too little to the complete record of the flood which is needed to compute the effect of storage on spillway capacity. The Association should lend its aid to flood flow studies as well as the continuance of run-off records. Federal government aid for flood studies has never been granted to any considerable extent and at last accounts the run-off records were suffering from misdirected economy. More recording gages which will give the whole record of floods should be set up. Examination of the spillways of existing dams needs to be continued by owners and by regulatory authorities; but to make these examinations intelligent, well defined principles and standards are needed and the writer believes that engineering societies have not progressed satisfactorily in supplying such standards.

PIPE LINES

Progress in construction of improved types of pipe and in means for protection of pipes from corrosion and loss of carrying capacity has continued until we now have more satisfactory products than we would have dared to hope for two or three decades ago. The engineer may select from the following and other meritorious products:

1. Cast iron pipe lined with cement mortar or with spun tar enamel. Centrifugally cast pipes and pipes cast horizontally in green sand, all of these types of stronger iron than in pit cast pipes, are rapidly replacing pit cast pipes, particularly in sizes 12-inch and smaller and increasingly in large sizes up to at least 30 inches. These pipes are lighter for the same strength than pit cast pipes.
2. Welded steel pipe lined with spun tar enamel or cement mortar and covered if desired with tar enamel protected by wrapped cement or covered with wrapped cement mortar alone. The exterior coverings may have reinforcement if desired.
3. Spiral steel interlocked and welded pipe lined and covered with cement mortar or any of the other means of protection; or spiral steel pipe welded without interlock and protected by any of the means mentioned.
4. Reinforced concrete pipe made by centrifugal methods or by casting in a form. For tightness, particularly for heads above about 75 or 100 feet, these latter are made with enclosed steel cylinder and metal bell and spigot jointing rings welded to the cylinder.
5. Transite pipe, made of asbestos and cement by wrapping and compressing around a mandrel.

All these products will give high and lasting flow coefficients. Judging by statements of pipe company sales offices, only about 10 percent of consumers have learned that in buying pipe one buys capacity not just a tube to bury in the ground. These 10 percent know that metal pipes protected as in the past generally show surprisingly low capacity even when they look fairly free from tubercles. Such consumers buy the cement mortar lined or refined tar enamel lined metal pipes, or buy non-metallic pipes, thus securing a good degree of certainty of well sustained capacity.

In praising the progress which has made available many good types of pipe and coatings, the speaker would make a qualification that the cement used in lining pipes is not yet as satisfactory as would be desirable. It dissolves in soft water, making caustic water. This is objectionable not only to the consumer, but also to the pipe owner as it means deterioration, shortening of life, and reduction in carrying

capacity. Dipping in hot tar as a protection for the cement lining is generally practiced in England and has been used in this country, particularly in New York City. At present asphalt paint protection over the cement lining is being used here when any protection is specified. One make of cement lined steel pipes is said to have an improved cement, but this is not yet in general use. Less soluble cement if obtainable might also be used in concrete pipes and in other pipes containing cement as well as in water supply structures of all kinds.

Two methods of reconditioning existing pipes about 36-inch in diameter and larger have received a well-deserved start in this country. One method consists simply of cleaning the pipe and applying by hand-brushing a priming coat and a coat of refined tar enamel. The other method consists of cleaning and applying a cement mortar coating by a machine invented by A. G. Perkins. Reconditioning *in situ* of existing cast iron water mains of 16-inch and less in diameter is now being practiced in New Zealand, Australia, and England by the Tate process which consists of first cleaning and then applying a mortar lining by means of a mandrel dragged through the pipe against a charge of mortar previously forced into the pipe line at one end. All these methods are progressive and should grow in use.

There is a continued tendency toward increased use of lead substitutes of the sulphur compound type for jointing material on account of less cost and generally increased water-tightness. There is also a growth in the use of special joints, using rubber gaskets or packers, in subaqueous lines where flexibility as well as tightness is important, and in suction lines where air tightness is important. Leak clamps containing rubber packers, developed at first for use in making tight leaky bell and spigot joints in gas mains, have been adapted for bell and spigot water pipes also, and are coming into use for repairing joints where shut downs for remaking of joints are difficult or impracticable.

REPORT OF COMMITTEE ON LICENSING OF WATER WORKS EMPLOYEES

The American Chemical Society and the American Public Health Association have had committees studying this question and have issued separate reports covering their recommendations. This report is issued, not as a challenge to some of their conclusions, but as a supplement based on a thorough study of the results of licensing in states which have had licensing regulations in effect. In preparing this report, an attempt has been made to summarize, not only the opinions of the committee but information obtained by correspondence with nearly 100 water purification plant operators from various sections of the country. Some of the operators did not favor licensing, but did not offer valid objections to it except to say that they were not in favor of it. In a census taken from representative states where water works operators are licensed, the committee did not have a single reply from a licensed operator who did not favor the regulations under which they were working.

PRESENT STATUS

New Jersey and Michigan have specific laws requiring registration of water purification plant operators. West Virginia, after observing the success of the venture in these two states, made use of a law which permits the Public Health Council of the State to issue regulations pertaining to the proper operation of filter plants. All licensing has been under these regulations which have not been tested in the courts. The sentiment has been so strong for the licensing by both public and private companies that no difficulties have arisen in its administration.

The Texas Water Works Association has established a voluntary system of licensing which has proved very popular with the operators. All of the regulations were drawn up by the Association and the issuing of licenses is not under the direction of the State Department of Health.

In Ohio, a law, "Engineers and Surveyor's Registration Act," went into effect January 1, 1934. According to the interpretation of

this Act it has been necessary for men in charge of water treatment plants in Ohio to apply for a "Professional Engineer's" license. The license board, in granting licenses for water plant operators, has issued a certificate to such operators as "Professional Engineers" in the branch of "water purification plant operation," "chemical engineer," "water works operator," etc. Thus, many water works men who are not engineers have been compelled to apply for and have been granted a license as engineers. The State Department of Health has no authority over the granting of such licenses to water works operators but has been consulted sometimes in reference to various applicants. This law is cited, not as an example to be followed, but as a practice to be avoided.

PROPOSED LEGISLATION

The Pennsylvania Water Works Operators Association had a committee studying licensing for several years and this committee prepared a bill for submission to the Legislature. Printed copies of the proposed bill were sent to all members of the Association for a straw vote on the advisability of submitting the bill at this time and the vote was decidedly against the bill. Several members of the Association expressed the opinion that the bill was presented to the members at too late a date to make a proper study of it.

A committee of the Illinois Section of the A. W. W. A. prepared a bill which was submitted this year to the Legislature of Illinois. New York prepared bills governing the registration and licensing of employees in that state. North Carolina, Colorado and several other states have requested information from the committee relative to laws and regulations.

States which license water works employees are:

1. Michigan
2. New Jersey
3. Ohio (a)
4. West Virginia
5. Texas (b)

(a) Ohio operates under the Registration Law for Professional Engineers.

(b) Voluntary licensing by the Texas Water Operators' Association.

States which have laws which would probably allow licensing are:

1. Alabama

2. California
3. Kansas (a)
4. Kentucky (b)
5. Maryland
6. Wisconsin

(a) Attorney General has been requested by the State Department of Health for an opinion as to the legality of registering operators.

(b) Laws are adequate, but due to certain conditions which have existed in this state, it has not been thought advisable to attempt to enforce it.

NEED FOR LICENSING

Most states in the Union have laws requiring that all stationary engineers shall have a license; railroads require extensive training followed by both mental and physical examination before a man can take a locomotive on the main line; steam boat operators must qualify before they are permitted to move out in the stream, but the water plants are operated by men without due regard to their fitness and qualifications. None of the above mentioned jobs which are practically universally licensed, could harm many people through incompetence, while an incompetent plant operator, through ignorance or design, could cause a calamity more terrible than almost any disaster which could befall a community. Water purification plant operators should be registered solely as a protection to the public against incompetent operation of the water purification plant which might (and has) resulted in great disasters to the public health.

According to the 1930 population figures, the combined population of the 48 states was 122,288,177 and the total urban population 68,467,954. It has been estimated that about 58,000,000 people are using water which has had some form of treatment. Roughly, five out of six urban dwellers in this country are now supplied with treated water. These fifty-eight million people were served by 3,015 plants in 1930 and it has been estimated that 300 additional plants have been installed since that time. Municipally owned plants predominate with 1,874 (62%), while privately owned plants number 1,141 (38%). Certainly with so many different plants operating in the United States, it seems advisable to have some form of regulation which is practically universal. The American Public is a traveling public and should be assured of a safe water wherever

it travels. Universal licensing of purification plant operators with uniform standards (such as the U. S. Treasury Department Standards) of purity as a guide, would serve to improve the quality of water in most states.

ADVANTAGES OF LICENSING WATER PURIFICATION PLANT OPERATORS

Mr. P. L. McLaughlin, Sanitary Engineer, West Virginia Water Service, Charleston, W. Va., writes as follows:

"In reply to your letter of February 8, 1935, requesting a statement from me giving my opinion of the water works registration in West Virginia, I will say that I am heartily in favor of the plan of registration as carried out in this State, for the following reasons:

"(1) Under the registration plan, better men operate the plants, and the water consuming public is provided with a safeguard which would not ordinarily be obtained without such requirements for registration.

"(2) Registration gives the various plant operators a certain amount of "professional" standing and feeling, in which they can take pride. In many cases registration provides a stimulus for a man to improve his knowledge of purification and to qualify for a higher class certificate than he originally secured. Registration should weld the operators into a kind of fraternal organization, which would be advantageous to both the public and to the advancement of the science of water purification.

"(3) Registration will undoubtedly serve to create a needed recognition among many non-technical water works officials of the value and necessity of close sanitary supervision by specially trained personnel, and, as such, is a step I think, towards raising the standards, as well as appreciation of the value, of the sanitary engineering profession.

"(4) In an organization such as the West Virginia Water Service Company, which operates fifteen different water supplies in the State, the registration of operators provides a means of classification and rating of the various operators. This is desirable from a standpoint of company organization. In addition, it provides a means whereby certain unqualified men can be discovered and a lever by which these men can be replaced. The latter also holds true, of course, for the functions of the State Department of Health. . . . . "

Mr. Perkins Boynton of the Clarksburg Municipal Water Department writes:

"The re-action upon the operator is that he feels he has a pledge to the public to maintain the highest standard of performance of the duties involved."

One member of our Committee writes:

"I am not fully sold on registration but it should have the following advantages:

(a) Protection of the public health.

(b) To elevate standard of operation.
(c) To facilitate Health Department supervision and control.
(d) To obtain for the position professional status.
(e) To increase the confidence of the Public in Health Department Supervision."

Another member writes:

"(a) Licensing will insure proper personnel in charge of water treatment plants.

"(b) A license will raise the standing of an operator in his community and will call attention locally to the responsibility of the position.

"(c) Licensing should tend to prevent the appointment of unsuitable persons to water works positions through political or personal influences. Licensing will thus enhance the dignity of the profession and will encourage high class men to enter and remain in this field."

With approximately 2000 municipally owned plants in the United States, some regulations are needed to prevent wholesale turnover of water works personnel every time there is a change in political administration. There are many inherent advantages of licensing which will accrue to the operator, but the real plea is the additional safeguard it places on the public health of a community.

Another committee member concurs with most of the previous statements and adds the following:

"(a) Licensing operators directs attention to the public to the need of qualified men to fill the positions of plant operators, whereas at the present time this fact is not recognized by those who make up the various communities dependent upon treated water for their water supply."

"(b) The educational qualifications that would be set up in connection with licensing would encourage the present operator to pursue courses to better qualify such persons for their work.

"(c) The establishment of licenses for operators will encourage operators to join together in various associations to discuss common problems, methods of meeting these problems and other subjects which will be of aid in securing more effective operation of public water supplies."

SHOULD LICENSES BE RENEWED EACH YEAR?

The consensus of the committee is that licenses should be renewed each year. The method of renewal should be by certification by the State Department of Health. The fee for renewal should be nominal and several members of the committee feel that no fee should be charged. Annual renewal of a license will prevent men from getting the idea that their jobs are perpetual and will have a tendency to

keep them better prepared for their jobs. One member feels that licenses should be for a period of five years.

METHODS OF CERTIFICATION

Original certification should always be by examination and all transfers from lower to higher grade should be by examination. This examination should be written and in some cases, supplemented by oral interview.

The so-called "Grandfather Clause" in all probability would have to be included in any registration law on account of legal requirements, but when dealing with a problem so vitally concerning public health it would be advisable to eliminate it wherever practicable. In West Virginia, operators who were employed at the time the regulations became effective were given one year to get their certificates. This resulted in little criticism as the average operator took pride in the fact that he could obtain a license. A number of the men who could not pass the examinations were sent to the State University for special training, if they had been employed for more than one year. Some operators had to go to school two sessions before they could pass the examination. The psychological effect of having all of the existing operators study and review their water purification makes the elimination of the "Grandfather Clause" advisable where it is legally practicable. The committee feels that certification should always be preceded by a good will publicity campaign to get the operators themselves in favor of it before any law should be submitted to legislatures.

A license to operate a plant should be for the plant which the operator is working and the State Health Department should decide if he is qualified to operate another plant without examination. Arrangements should be made whereby a man licensed in one state could have his license transferred to another state with the approval of the State Department of Health.

CLASSIFICATION OF WATER WORKS OPERATORS

First Class:

All municipalities where sedimentation, coagulation, filtration, etc., or softening are used in communities with over 25,000 population.

Slow sand filtration in towns over 50,000 people.

Second Class:

All municipalities where sedimentation, coagulation and filtration, etc., are used regardless of the size of the community.

All municipalities having water softening plants.

Slow sand filtration in towns under 50,000 people.

TABLE 1

Qualifications for water works operators

TRAINING	EXPERIENCE
First class*	
	years
Graduate of a recognized college with degree in: Sanitary Engineering	1
Public Health	1
Chemical Engineering	1
Civil Engineering	2
B.S. Chemistry Major	2
Bachelor of Arts with courses in water chemistry	3
or	
Two years college	5
Graduate of High School or less than high school education.	5–10
Second class	
Graduate of a high school or its equivalent with additional training in water chemistry and bacteriology	2
or	
Pass a comprehensive examination	5
Third class	
Pass a comprehensive examination	2

* All applicants for license in first class should be required to pass a written examination.

Third Class:

All municipalities which employ disinfection only as a process of treatment.

Operators in charge of shifts under direction of a first or second class operator which employs sedimentation, coagulation, filtration, etc., or softening.

In the United States there are over 400 plants in towns of less than 2000 population which employ sedimentation, coagulation, filtra-

tion and sterilization of the water supply. Of these 400 plants about 175 are in towns of less than 1000 people and a goodly number in towns of less than 100 people. The requirements listed above should be the minimum for any water works plant. Three members of the committee felt that population should not be considered as the public health in a small community is just as important as the health in a large city. The commitee feels that it is not feasible to require a town to have a class of operator it cannot afford. In most cases it would be possible to have a first class operator of a nearby town supervise the operation of the smaller plant which could be under the control of a lower class operator.

The requirements recommended in this report are somewhat lower than those proposed by the American Chemical Society report and nearly the same as the American Public Health Association report. An attempt has been made to make a thorough study of the experiences of the states of Michigan, New Jersey, and West Virginia, where licensing has been in use and the committee believes that the proposed requirements based on actual experience will give the best regulations. There is no advantage in setting up requirements which are not workable at the present time and these requirements could be raised in certain states after the licensing has been in effect for some years if the conditions warrant it. As this report is being written, the State of West Virginia has made its requirements more rigid because the class of operators has improved so much that a higher standard can now be set.

PUBLICITY

The attempt to pass a law requiring licensing of water purification plant operators should be preceded by an extensive publicity campaign on all phases of the regulations. The average operator is unacquainted with what licensing will do for them. Many are suspicious of the movement, fearing that it will throw them out of their positions, rather than maintain and make more secure the place for competent men. Again, it should be emphasized that the movement will protect the public and is not aimed toward closing the gates to others with a view to raising pay and costs to the public. In most states, the operators are not inclined to take the lead in a movement to pass a law requiring licensing. The Committee feels that the American Water Works Association can exert a decidedly beneficial

influence on the future of licensing by fostering and sponsoring regulations governing this movement.

Respectfully submitted,
H. E. BABBITT
W. W. BRUSH
F. C. DUGAN
C. A. HOLMQUIST
W. A. KNOX
ABEL WOLMAN
LEWIS V. CARPENTER, *Chairman,*
Committee on Licensing Water Works Employees.

DISCUSSION

CHESTER COHN (*State Department of Health, Austin, Texas*): "Seventy to eighty percent of the plants in the state of Texas are well supplies which are pumped direct to the consumer without sterilization." He suggests the addition of a further classification in licensing filter plant operators to take care of this class of pump operator. "It is realized that there are a number of things, such as the proper sanitary conditions about the well, in reservoirs, and in distribution systems, which would make it highly desirable that a man operating a well supply even without sterilization, should have some knowledge of the sanitary treatment of water." He feels that this class of operator should be included in any licensing law.

W. W. BRUSH (*New York, N. Y.*): "Third class operators should not be used in towns over 100,000 population. All towns over 100,000 should require a first class operator. The principal arguments are that in a large city which handles many million gallons of water per day, there are generally more sanitary problems arise such as water shed control, reservoir sanitation, and the proper handling of the distribution system. Plants which have a number of outlying chlorinator plants connected to a central system could well have a third class operator operating the chlorinator plants and being responsible to a first class operator in charge of the entire system." He cites the cases of New York City and Chicago, where certainly first class operators should be in charge of the plants.

CHARLES R. COX (*State Department of Health, Albany, N. Y.*): "The State of New York has 301 supplies out of 680 which are treated and the Department of Health favors a distinct population division

for the class of operator required, because in a larger city dealing with a larger daily supply, there are always more problems, regardless of the amount of treatment." He, like Mr. Brush, favors first class operators in towns over 100,000 if chlorination is the only treatment.

W. H. WEIR (*Atlanta, Georgia*): "The operation of a plant which depends entirely on sterilization as the only form of treatment, should require a much higher class of plant operator than the plant which has complete treatment, because the chlorination is the only factor of protection to the public. Some of the problems which a chlorinator operator should know are the method of sterilizing mains; watershed sanitation; correction of algae problems both in distribution systems and the distributing reservoir." Mr. Weir favors somewhat Mr. Cox's idea of a distinct population classification for the various classes of operators.

ARTHUR E. GORMAN (*Chicago, Ill.*): "The American Water Works Association could issue regulations and license men in the various classifications through their membership in the A. W. W. A." Some form of voluntary registration would tend to develop registration over the United States much more quickly than could be obtained by regulatory laws in the 48 states. It would give a better hold of the A. W. W. A. on the various towns and that public sentiment could rapidly be developed whereby the towns would be glad to employ men who carried a licensed certificate from the Association. It is practically a hopeless task to wait until all the states pass the necessary laws. He is very much in favor of licensing, but questions if it will give as profitable and quick result with legal compulsion rather than voluntary registration.

WILLIAM U. GALLAHER (*Appleton, Wis.*): "The 'Grandfather Clause' which is necessary should any law be passed, might place a large number of existing operators in a rut who would not want to get out of it." He is distinctly in favor of licensing but feels that more speed can be made by having the Department of Health issue regulations rather than try to get all classifications in a law. He also called attention to the fact that it would be impossible to use the same regulations in all of the 48 states.

CHARLES L. FOX (*Pennsylvania Water Co., Wilkinsburg, Pa.*): Does not believe that licensing filter plant operators would help the situation as far as filter plant operators are concerned, and feels that their plants do everything they possibly can without having to be inflicted with regulations. The key to the situation lies in having

state regulatory bodies of a much higher class, who can act in a semi-consulting capacity when the plants get in trouble. The annual renewing of licenses should be in charge of that kind of a body, provided it would be possible to get a high class body. He also pointed out the fact that some of our best operators could not pass a written examination, and objects to a written examination for filter plant operators. Instead of having three classifications, any license law should contain five, the extra two classifications being for consulting engineers so that they will design plants properly, and the other for state regulatory bodies so that they will have the proper men in charge of the plants. He feels that if these two classes are satisfied, there will be little or no use for licensing filter plant operators.

JAMES M. CAIRD (*Troy, N. Y.*): Mr. Caird cited the case of the water works schools being conducted by New England states and several of the Central States for training filter plant operators, and feels that that class of work is of much more advantage to the water works men than trying to have licensing. He said that he had a number of filter plant operators under his control who were very excellent operators but who could not possibly pass a written examination.

W. A. PEIRCE (*Racine, Wis.*): Mr. Peirce is very enthusiastic over conducting short schools for filter plant operators, and cited the case in several Wisconsin plants where schools were conducted in each plant for the benefit of the men in their local plant, and felt that this was an excellent system. Mr. Gorman also cited the case in the city of Chicago where they held a school once a month and found it very satisfactory.

R. F. GOUDEY (*Los Angeles, Calif.*): "Investigation by the State Licensing Board showed that it would cost approximately $25 for each license which would be issued in the State of California, and that they had to resort to schools rather than attempt to license on account of the cost." The Chairman pointed out that in most of the states which have had licensing the cost was less than $1.00 each, and believes that the ordinary form of license can be carried out for that figure.

E. S. HOPKINS (*Bureau Water Supply, Baltimore, Md.*): Contrary to the opening statement, the Water, Sewage and Sanitation Division, American Chemical Society did not and does not, propose to raise the question of plant licensing. Their report was in the nature of a study to establish basic data of optimum qualifications, for the guidance of local authorities in choosing such personnel.

The licensing problem appears to fall into two phases. Is the *average* plant operator comparable in training and ability to that of the doctor, dentist or lawyer or with that of the stationary engineer or plumber? If in the first grouping, then an initial professional examination and license good indefinitely would be the proper procedure. If in the second catagory then a renewal of license after examination at stated periods would be comparable. This is based upon the premise that the professional examination and license is to determine the initial fitness of the individual with reliance on professional prestige and standing to give assurance of his continued capability. Such a situation applies to the highly trained personnel of the large plants. On the other hand, the typical yearly renewal of the stationary engineers' license is a check upon his integrity and efficiency and tacitly assumes a non-professional background.

With the large plants under supervision of personnel with professional background and the smaller ones usually in charge of licensed stationary engineers, it is apparent that no general system of licensing or examining could be successfully adopted. Professional reputation and efficiency are the controlling factors for one class of operator and a renewal of his technical license for the other.

Considering all data, the need for licensing plant operators has not been shown as a necessity. With many of the states holding the question in abeyance or rejecting it, as shown by legislative action in 1934, it is questioned if there is a general demand for the movement.

Regulation would not improve the "professional" standing of the technical operator or raise to any degree the standards. The small plant must employ the technical man and the large will utilize the professional type. The remedy lies in educating the appointing authority to a realization of the fundamental science involved with a resultant appreciation of the well trained professional personnel instead of the technical type. This is a task for the sanitary engineering departments of the various States.

Better protection of the public health can be secured by other methods than by licensing. Potential political control enters into such a system, particularly if yearly renewals are enforced. The various State Departments of Health have authority to regulate and supervise the efficiency of plant operation. Therefore, if given the power to prefer charges of inefficiency and incompetency or negligence against plant operators, with the local appointing authority, much could be done to maintain health.

Criticising the detailed plan of training as submitted, I see no reason

for placing the course in public health equal to that of sanitary or chemical engineering in relation to experience equivalents. The A.B. course in chemistry should be made equal to that of the B.S. in experience. A new book has recently been published at the University of Minnesota, giving all of the details of testing for water work, so another is *NOT* needed.

It appears to me that a committee of the Association could serve to advantage as a clearing house for information relating to short school practice and procedure, but should *NOT* attempt to set up courses or dictate policy.

CONFERENCE ON THE PART THE AMERICAN WATER WORKS ASSOCIATION CAN PLAY IN THE CONDUCT OF SHORT SCHOOLS FOR FILTER PLANT OPERATORS

The entire group of men who had assembled for the Conference on Licensing remained for the conference and every man present, while not enthusiastic about licensing, was enthusiastic about the benefits to be derived by conducting short schools in various parts of the country. Some of the leading schools which have been conducting short schools are Massachusetts Institute of Technology in coöperation with the New England Water Works Association; Georgia School of Technology, in coöperation with the Georgia State Department of Health; University of Wisconsin, in coöperation with the Wisconsin Section of the American Water Works Association; Penn State College, in coöperation with the Pennsylvania Water Works Association; Virginia Technical Schools in coöperation with the Virginia Section of the American Water Works Association and the Virginia League of Municipalities; University of Florida, in coöperation with the Florida Section of the American Water Works Association; West Virginia University, in coöperation with the West Virginia State Department of Health.

Representatives from all of these schools were present and exchanged their views relative to the part the A. W. W. A. should play in furthering the aims of this type of school. The following suggestions were made and are submitted for your consideration:

1. Appoint a committee of engineers and water works men to act as a referee on various matters in connection with short schools, to act as a clearing house for data and to publish in pamphlet form bulletins to be sold to the various water works men at cost, which would make suitable text books for studying various phases of water works practice.

It is realized that our Standard Methods of Water Analysis gives all of the information that a trained man needs to guide him in his laboratory procedure. There is no text book on the market which has gone into the subject in as elementary a manner as is necessary, particularly for the operator who has not had even a high school education, and the general consensus of opinion is that some very elementary pamphlets could well be published by the Association for distribution at cost through the Committee on Water Works Short Schools.

Some discussion was made relative to the various state water conferences and it was concluded that the average state conference was not a school, but just another meeting where eminent men talked to the average operator in language far above what he is able to grasp, and feel that the water works short schools should be confined to a small number of registrants, and that these registrants should have the opportunity of actually performing and doing the work which they would do in their own laboratory. This procedure is followed at several of the schools including West Virginia University, and has been found highly practical.

Mr. Paul Weir of Georgia, and Mr. Gallaher of Wisconsin, believe that the Association could well establish a Committee on Short Schools for the purpose of disseminating information and particularly to conduct an educational campaign and collect and publish material to be used as text books.

Your Chairman feels that a proper committee, properly organized, could probably do very good missionary work for the Association by contacting and serving as a clearing house for information, curricula, and schedules for short schools.

REPORT OF SECTIONAL COMMITTEE A-21 ON SPECIFICATIONS FOR CAST IRON PIPE

This report is made at the request of the Committee on Water Works Practice. The American Water Works Association is one of the sponsor associations which have supported Committee A-21 on Specifications for Cast Iron Pipe. The other associations are the New England Water Works Association, the American Society for Testing Materials, and the American Gas Association. The committee functions under the rules of the American Standards Association, and the Committee's membership of about 38 was selected to give a balanced cross section of groups concerned with cast iron pipe, including producing, consuming, and general interests.

The Sectional Committee has an executive committee, with several administrative sub-committees, three main technical committees, and 14 sub-committees of the technical committees. Technical and sub-committees have producer and consumer personnel to the number of about 64 outside the membership of the Sectional Committee proper, so that the total personnel numbers about 102.

The Committee was formed in 1926 as a result of a movement started by the American Gas Association to have its then existing standard adopted as American standard. Instead, Committee A-21 was formed with the approval of the Gas Association and was given the broad scope of standardizing cast iron pipe and fittings for all purposes—gas, water, oil, and even soil pipe uses. The latter was early eliminated from the Committee's program.

The men who took the lead in starting the Committee on its way, among whom were Mr. F. A. Barbour, Mr. W. W. Brush and the writer of this association, Mr. W. Cullen Morris and Mr. C. C. Simpson, Jr., of the American Gas Association, and Mr. C. L. Warwick of the American Society for Testing Materials and Mr. N. F. S. Russell, President of the U. S. Cast Iron Pipe and Foundry Company, were agreed that it would be futile to thresh over the old straw of former specifications and that a new fundamental attack ought to be made by the aid of tests. The producers agreed to contribute to the support of this work and did so liberally as this Association is aware from previous reports. It is well at this time however to again acknowledge their broad-minded attitude. The four sponsor bodies

have also been most liberal and patient in their support of the Committee, and this Association has been especially generous in its encouragement during the recent months when the Committee has been struggling to bring its labors to fruition.

The Committee started with a program of investigation and experimentation which was outlined by the writer at the request of the men above mentioned, and this program has been carried through with additions and many variations in detail but without swerving from the original purpose as previously stated.

Final action has not been taken by the main Committee on many important matters, but sub-committees and technical committees have progressed on many of them and some decisions and accomplishments may be indicated at this time as noted below.

1. A general metallurgical review was made resulting in the conclusion that specifications for process and for metallurgical control in general are unwise. The Committee has under consideration, however, recommendations of one of the sub-committees to place a limit of 0.10 percent on sulphur and one of 0.90 percent on phosphorus.

2. A very complete series of laboratory corrosion tests was conducted for the Committee at the Massachusetts Institute of Technology by methods closely simulating practical exposures though accelerated. From these the conclusion was reached that no practicable variations in iron mixtures will materially change or reduce the corrosion problem. Only by the addition of silicon so high in percentage that the expense would be prohibitive and the iron made brittle and impracticable to cut or tap is the corrodibility of cast iron greatly reduced. Such an admixture of silicon would be a long way toward the so-called Duriron used for carrying alum solution and other corrosive chemicals. Protective coatings must therefore be the main reliance in preserving carrying capacity of cast iron pipes and in preserving their strength in the small percentage of cases where the environment is very corrosive.

3. A tentative specification for cement lining for pipes has been issued and is in use. Improvements are being studied. A tentative specification for improved coal tar coating and for testing its efficiency has been developed though not yet adopted. A tentative specification for refined tar enamel is under preliminary study.

4. Flow tests showing the loss of head in tees, crosses and bends 6-and 12-inch in diameter have been made. The tees and crosses were of four designs as regards inner-radii of intersections of runs and

outlets, viz., sharp or of zero radius, 1-, 2½- and 6-inch radius. From these experiments and studies of the losses in typical distribution systems it was concluded by the Committee that short fittings give no more total loss of head in distribution systems than do long fittings. A short body standard is therefore to be included at least in diameters of 12-inch and smaller.

In pumping stations where velocities are high long radius fittings were found desirable.

5. About 200 bursting tests to destruction of fittings in sizes 6- to 36-inch have been made, some by the Committee and many more by the producers in extension of the Committee's tests. By aid of these tests design of fittings as regards strength will be put on a sounder basis.

6. Experiments have been made on pull-out strength of joints and on strength of bells against stresses caused by bending of joints. From these tests and others, and from a considerable mathematical study of bells it has been concluded that there are no grounds for altering existing dimensions of bells. Bronze welded lugs, for holding harnesses in cases where need of lugs or collars has not been foreseen when castings were made, have been tested and found practicable. Designs will be included.

7. Most important of all, bursting and crushing tests have been made on straight pipes of sizes 6-, 12-, 20- and 48-inch laid under various conditions as regards support and with and without tamping of backfilling. The conditions of support under which pipes have been tested include blocks, flat bottoms of trenches and bottoms of trench hollowed out to fit 90° of the periphery of the pipe as in sewers. In many tests internal pressure and external loads have been applied simultaneously, and effect of combined loads analyzed.

These tests taken in connection with the results of years of testing of drain and culvert pipes at Iowa State College have demonstrated to the Committee that exterior or crushing load is generally an important part of the hazard to which pipe is subjected, and this hazard is often increased greatly by unfavorable methods of laying, as for example by use of block supports, particularly with blocks projecting above the bottom of the trench in the usual way, also by omission of tamping of backfill beneath and at the sides of the pipe.

A rational formula for computing thickness of pipe under combined external load and internal water pressure has been devised with varying constants to take account of favorable or unfavorable conditions of laying.

Pipe thicknesses have been computed by this formula and results correlated as well as is practicable with experience. It is expected that these pipe thicknesses with some revisions in process will form the basis of the schedules to be recommended to the sponsors both for pit cast and for special types of pipe.

8. Provisions have been made for publishing the experiments and studies made by or for the Committee.

Finally the specifications are in part drafted and it is hoped that a substantial part of them will be placed before the sponsor societies by this time next year. In expressing this hope before this sponsor body, the speaker is aware of being a little fool-hardy since these large committees with so many conflicting points of view cannot be hurried more than can the U. S. Senate. However, for the first time the progress in adjustment of views seems to warrant the hope and the speaker will not with-hold the expression of it. There still remain in abeyance some important decisions regarding bell and spigot and flanged fittings.

THOMAS H. WIGGIN,
Chairman, Sectional Committee A-21.

REPORT OF THE SECRETARY

STATEMENT OF FINANCIAL CONDITION FOR YEAR ENDING DECEMBER 31, 1934

ASSETS

Cash on hand	$520.93	
Accounts Receivable, Advertising	3,633.22	
Accounts Receivable, Manuals	30.00	
Accounts Receivable, Index to Proceedings and Journal, 1881–1933	116.50	
Accounts Receivable, Census of Water Purification Plants	34.50	
Inventory, Manuals	18.75	
Inventory, Index to Proceedings and Journal, 1881–1933	421.50	
Inventory, Index (type metal)	250.00	
Inventory, Census of Water Purification Plants	71.00	
Investments	33,848.65	
Office Equipment (depreciated)	1,538.37	
Accrued Interest on Investments	515.92	
Total Assets		$40,999.34
Less:		
Annual Dues, Advance Payments		276.98
Total Assets Representing Surplus		$40,722.36

SURPLUS

Balance January 1, 1934		$40,191.79
Adjustment of 1933 Receipts	$11.00	
Accrued Interest on Investments	515.92	
Adjustments of Inventory, Manuals	11.25	
	$538.17	
Loss on 1934 Operations	7.60	
Net Increase in Surplus, Year 1934		530.57
		$40,722.36

STATEMENT OF INCOME AND EXPENDITURE FOR YEAR ENDING DECEMBER 31, 1934

INCOME

Annual Dues	$25,587.95	
Advertising	14,983.25	
Subscriptions to Journal	2,416.14	
Sales of Proceedings	261.51	
Interest on Deposits	18.06	
Interest on Investments	1,600.12	
Manuals, Royalties	118.50	
Manuals, Sales	240.00	
Sales of Specifications	44.00	
Convention Registration Fees	3,822.50	
Convention Entertainment Tickets	799.35	
Water Works Mfrs. Assn. Annual Allottment	7,500.00	
Sectional Committee on Specifications for Cast Iron Pipe (reimbursement for Office Expense)	400.00	
Sales of Reprints	672.38	
Sales of Census of Water Purification Plants	216.21	
Sales of Index to Proceedings and Journal, 1881–1933	1,315.30	
Sundry	23.33	
	$60,018.60	
Profit on Sale of Investments	134.81	
Total Income		$60,153.41

EXPENDITURE

Convention Entertainment Expense	$3,228.50	
Convention Expense (balance)	1,201.53	
Office Expense	6,067.68	
Committee Expense	2,769.54	
Section and Division Expense	3,095.05	
Directors' Meetings	1,382.99	
Salaries	22,002.75	
Printing Journal	16,346.03	
Reprints	744.02	
National Recovery Committee	1,524.66	
Manuals, Purchases	195.00	
Dues in Construction League of the United States	100.00	
Publication of Census of Water Purification Plants	181.50	
Publication of Index to Proceedings and Journal, 1881–1933	1,102.76	

Depreciation, Office Equipment	$170.93	
Sundry	48.07	
Total Expenditure		$60,161.01
Excess of Expenditure over Income for Year Ending 12/31/34		$7.60

I certify that the above two statements are in accordance with the books and correct.

(Signed) A. B. Dorer,
Certified Public Accountant,
170 Broadway, New York, N. Y.

Membership statement for the year 1934

	ACTIVE	CORPORATE	ASSOCIATE	HONORARY	TOTAL
January 1, 1934	1,864	199	145	13	2,221
Gains:					
New Members	243	19	9		271
Restored	54		12		66
	2,161	218	166	13	2,558
Losses:					
Resignations	50	5	9		64
Deaths	20			2	22
Dropped for Non-payment of Dues 12/31/34	118	4			122
Total Losses	188	9	9	2	208
Total December 31, 1934	1,973	209	157	11	2,350
Total January 1, 1934	1,864	199	145	13	2,221
Gain or Loss in Year 1934	+109	+10	+12	−2	+129

Comparative statement—Gains and losses—seven-year period

YEAR	NEW	RESTORED	RESIGNATIONS	DEATHS	DROPPED FOR NON-PAYMENT OF DUES	GAIN OR LOSS	TOTAL MEMBERS AT END OF YEAR
1934	271	66	64	22	122	+129	2,350
1933	168	56	132	27	234	−169	2,221
1932	117	22	141	28	297	−327	2,390
1931	203	22	98	25	216	−114	2,717
1930	501	39	95	26	134	+285	2,831
1929	314	25	94	24	130	+91	2,547
1928	203	36	86	13	126	+14	2,456
Totals—7-year period	1,777	266	710	165	1,259	−91	

LIST OF SECTION PAPERS

Central States Section

Pittsburgh, Pa., August 22–23, 1935

Modern Methods of Controlling Electrically Operated Pumping Stations
S. A. Canariis

Experiences Encountered with the Treatment of Water from the Monongahela River ..... F. W. Bouson

Diversified Electric Rates and the Application Thereto to Water Rates
Nathan B. Jacobs

Water Work's Experiences from a Health Official's Viewpoint... H. E. Moses

"Behind the Water Front," a motion picture on Public Relations in the Water Works Field—with running comments by ..... Miller Hamilton

Some Model Experiments on Prevention of Erosion Below Overfall Dams
G. Gale Dixon

Disinfection by Chlorine ..... W. L. Mallman

Rocky Mountain Section and the Fifth Rocky Mountain Water Works College

Denver, Colo., September 16–18, 1935

Water Rate Structures ..... H. M. Krull

The Effects of Metering ..... H. L. McLaughlin

Water Storage vs. Direct Flow Rights ..... Malcolm Lindsey

Reforestation of Watersheds ..... Allen S. Peck

New Municipal Well Water Supplies ..... E. D. Charles

Movies: Malaria in New Mexico ..... C. M. Adams
Micro-organisms ..... John B. Hawley
Miscellaneous Commercial Equipment Films

Fluorine in Water ..... Willett R. Willis

Determining Factors in Selection of Sewage Treatment Processes
Burton Lowther

New Sewage Treatment Plants ..... L. C. Osborn and R. W. Gelder

Theory of pH Control and Coagulation ..... Dr. R. B. Gustavson

Hydraulics as Applied to Water Works Systems ..... R. L. Downing

Round Table Discussion

Licensing of Water Works Superintendents and Operators ..... O. J. Ripple

Emergency Sterilization of Water in Reservoirs and Wells
Paul S. Fox and B. V. Howe

Water Sterilization by Silver Process.....Dana Kepner
The Use of P. W. A. Funds.....George M. Bull and Earl L. Mosley
Activated Carbon with Coal as Filter Media..G. H. Palmes and O. J. Ripple
Porous Plates for Filter Underdrains.....George Turre

SOCIETY AFFAIRS

THE ANNUAL CONVENTION

The 55th annual convention of the American Water Works Association was held at the Netherlands Plaza Hotel, Cincinnati, Ohio, on May 6 to 9, 1935.

President Harry E. Jordan presided at the opening session and the officers elected for the year 1935–36 were announced: Frank A. Barbour, Consulting Engineer, Boston, Mass., President and William W. Brush reelected Treasurer.

The reports of the Secretary and Treasurer were presented, the Secretary showing 104 new members for the first quarter of 1935, representing 50 percent more than for the same period a year ago. Since the end of the quarter over 300 new members have been secured. A budget consisting of $62,535 for regular operations and $5,910 for extraordinary activities, or a total of $68,445, was adopted.

The changes in the bylaws to increase the representation of the Water Works Manufacturers' Association on the Board of Directors from one to three directors were approved for letter ballot by the members.

On motion by Nicholas S. Hill, Jr., Chairman of the Committee on Electrolysis and Electrical Interference, a resolution disapproving of grounding electric circuits on water piping, was adopted.

President Jordan introduced an innovation by reading a list of the members lost by death during the past year, with an expression of appreciation as to what they had done for the Association. There were four past presidents in this list: D. W. French, 1908–1909; Alexander Milne, 1911–12; George W. Fuller, 1923–24 and Harry F. Huy, 1925–26.

At the request of the president, Col. Willard Chevalier delivered an address which was a stirring tribute to the memory of Past President Fuller. At the conclusion of the address, on motion by Arthur E. Gorman, the convention approved of the appointment of a committee to recommend to the Association an appropriate plan to perpetuate in the Association, the memory of Mr. Fuller.

Tuesday, May 7, Morning

A paper on "Water Planning for the Nation" was read by Morris Llewellyn Cooke, Consulting Engineer, Philadelphia.

Thorndike Saville, Professor of Hydraulic and Sanitary Engineering, New York University, presented a paper on "Deficiencies in Present Water Resources Information."

These two papers were discussed by President-elect Frank A. Barbour and Abel Wolman, Chief Engineer, Maryland State Department of Health. Malcolm Pirnie, Consulting Engineer, New York City, then moved that a committee of five be appointed by the A. W. W. A. to investigate and carry out the purposes of the following resolution:

"The American Water Works Association endorses a comprehensive national water policy adequately evaluating the proper fields of action of federal, state and local agencies and offers cooperation with the National Resources Board and other agencies to develop and effectuate immediately such a policy." The convention unanimously approved this motion.

A resume of the "Drought of 1930–34," was presented by Earnest Boyce, Chief Engineer, Division of Water and Sewage, Kansas State Department of Health and by W. H. Knox, Assistant Engineer, State Department of Health, Columbus, Ohio.

An unusual motion picture showing the propagation growth and movement of various kinds of microscopic organisms found in water supply, was shown by John B. Hawley, who also presented a paper on the "Water Supply in Paris."

Tuesday, May 7, Afternoon

Dam construction features were described by Leslie W. Stocker, Chief Civil Engineer, Hetch Hetchy Water Supply, in his paper "Some Engineering Features of the Enlargement of the O'Shaughnessy Dam."

The "Design and Construction of the Morris Dam," were fully described in a paper by Samuel B. Morris.

The Bouquet Canyon Dam and Inlet-Outlet Pipe were described by W. W. Hurlbut.

The Current Situation in the Public Works Program was discussed by Malcolm Pirnie.

The subject of "Sanitation Requirements for Convention Hotels" was presented by F. H. Waring and was discussed by Joel I. Connolly.

Wednesday, May 8, Morning

C. A. Dykstra, City Manager, Cincinnati, Ohio, presented a paper entitled "Future Growth of American Cities."

Col. Henry M. Waite, Director, Regional Department of Economic Security, Cincinnati, could not be present and his paper on "Economic Security" was read by Howard S. Morse, General Manager, Indianapolis Water Company.

"Reconditioning Water Supply Lines With Bituminous Enamel," was described by Linden Stuart, President, Wailes Dove-Hermiston Corporation, New York City.

A different method of reconditioning large diameter mains was described by Elson T. Killam under the title "Cement Lining of Large Diameter Mains in Place by Centrifugal Machine."

The reconditioning of small distribution pipe in place was described by Thomas H. Wiggin in a paper entitled "Applying Cement Mortar Lining to Existing Mains in England."

These three papers were discussed by Mr. F. N. Speller, Director, Department of Metallurgy and Research, National Tube Company, Pittsburgh, Pa.

SUPERINTENDENTS' ROUND TABLE

There were two Superintendents' Round Table discussions, one on Monday afternoon and the other on Thursday afternoon. Both were very well attended, the average number present being well over one hundred. While there were 39 subjects scheduled for discussion, it was evident that the majority of subjects would not be discussed unless some one was prepared to open the discussion. Therefore, many of the topics scheduled were not discussed.

"Theft of Water" was presented by C. M. McCord, General Superintendent, Water Department, Memphis, Tenn., and was followed by Lewis M. Quigley, Superintendent of Water Works, Fort Worth, Texas, on the subject "Service Connections to Water Mains."

"Stub Billing for Water Bills" was presented in a paper by T. G. Banks, Superintendent of Water Works, Oklahoma City, Okla.

"Does it Pay to Deliver Water Bills by Hand?" was introduced by John Chambers, Chief Engineer and Superintendent, Louisville Water Company, Louisville, Ky.

In the discussion of "Storage Yard and Material Handling," by W. V. Weir, he advocated carrying stocks just large enough to meet emergencies.

J. Walter Ackerman, Chief Engineer, Consolidated Water Company, Utica, N. Y. discussed the question of service lines. Mr. Gibson and Mr. Blomquist entered into this discussion.

T. J. Skinker, Distribution Engineer, St. Louis, Mo. and H. W. Griswold, Deputy Chief Engineer, Hartford, Conn., discussed the present A. W. W. A. meter specifications.

Mr. Gibson discussed the subject of pipe locators and W. V. Weir spoke on repairing meters.

The discussion on using cast iron pipe in lengths longer than 12 feet developed the fact that no one was having trouble due to the longer pipe, although it was pointed out that unless the strength of the pipe metal was greater there would be an increased likelihood of breakage in the pipes that were 8 inches or less in diameter, due to the beam action and the longer beam length between joints.

On the subject of the inspection of fire hydrants and division of responsibility between fire and water departments, it was brought out that in at least three American cities the fire department actually owns the fire hydrants and pays for their installation. Those present agreed that it was desirable that the water department should be solely responsible for the condition and maintenance of the fire hydrants.

In discussing the use of several small meters as compared with one large meter, C. M. McCord, stated that in Memphis, Tennessee, a test had been run to determine the relative effectiveness of various combinations of meters and with various rates of flow. The tests showed that better results have been obtained where there were several 2-inch meters used than where larger compound or tandem meters had been used.

Mr. Gibson reported that in Charleston, South Carolina, he had tried out two 4-inch meters on a 6-inch connection with very satisfactory results.

Generally water departments which have organized to meet emergencies have arranged to have employees reached by a telephone when the emergency arose. In some instances, a slight additional payment was made to the employee to remain within reach of telephone from the time that he arrived home until he again reported to duty. Usually, three or more men would be designated as the men to be reached in case of trouble. At Syracuse, New York, it was reported that the emergency truck was equipped with a police receiving set so that word could be sent to the emergency force if there

was need for their services on a large break. The larger cities, generally, have one or more emergency crews on duty throughout the 24 hours and in some instances, utilize night working crews thus increasing the number of men on duty at all times.

A number of factors that enter into the question of public relations were included in the discussion on "The Superintendents Position Relative to the Public and the Governing Body," by R. B. Simms, Superintendent, Spartanburg, S. C.

"Waco and its Experiences with the Commission Management of its Water Works," was explained by George J. Rohan, Superintendent, Waco City, Texas.

Thomas L. Amiss read a paper on "Painting, Marking, and other Characteristics of Fire Hydrants."

"Is a Record System of Underground Water Mains Justifiable" was presented by E. A. Munyan.

Three reviews were made of the development in the water works field during the past year: (a) dams and pipe lines, by Thomas H. Wiggin; (b) the purification field, by Linn H. Enslow; and (c) the water distribution field, by William W. Brush.

James E. Gibson, Chairman of the Nominating Committee for the Plant Management Division, reported that the committee recommended William W. Hurlbut, Water Distribution Engineer, Los Angeles, Cal., as Chairman of the Plant Management Division for the year 1935–36. By unanimous vote, Mr. Hurlbut was elected Chairman.

WATER PURIFICATION DIVISION

Monday, May 6, Afternoon

"Determining the Bacteriological Quality of Drinking Water" was presented by C. T. Butterfield and J. K. Hoskins.

H. W. Streeter presented a paper on "Limiting Standards of Quality for Sources of Purified Water Supplies."

"Results of Algal Activity, Some Familiar, Others Obscure" was the subject of a paper by W. C. Purdy.

Tuesday, May 7, Afternoon

"Report on a Study of Various Selective Media for Coli-Aerogenes Isolation" was presented by John F. Norton and C. C. Ruchhoft.

R. E. Noble presented a paper on "The Relative Productivity of Certain Culture Media and Differences of Growth Response by Single Strains, as Measured by the Butterfield-Hoskins Method."

A "Report of the Committee on Tests and Specifications of Chemicals Used in Water Purification" was presented by Mathew M. Braidech.

Wednesday, May 8, Morning

E. L. Buller, Research Engineer, The Hudson Coal Company, spoke on "The Preparation of Fine Anthracite Coal for Use in Filter Plants."

"The Determination of Dissolved Oxygen" was presented by C. H. Fellows.

F. W. Gilcreas spoke on "Colorimetric Dissolved Oxygen Method."

The Report of the Committee on Testing Zeolites was presented by Charles P. Hoover.

FINANCE AND ACCOUNTING DIVISION

The subject of "Sales Taxes in Relation to Water Utilities" was discussed by Dale L. Maffitt, General Manager, Des Moines Water Works, Des Moines, Ia.

M. F. Hoffman, Commercial Superintendent, Cincinnati Department of Water Works, presented a paper on "A Suggested Water Works Collection Procedure." Mr. Hoffman's paper was discussed by Emory C. Matthews, Assistant Secretary and Treasurer, Board of Water Commissioners, Macon, Ga.

A. S. Hibbs, Superintendent of the Department of Water Works, Cincinnati, Ohio, read a paper on "The Financial History and Present Financial Policy of the Water Department of the City of Cincinnati, Ohio."

Charles Haydock, Consulting Engineer, Philadelphia, read a paper on "Recording Physical Property Data," in which he pointed out that such records are essential to the satisfactory operation and maintenance of water works, whether publicly or privately owned.

A paper on "Relation of Engineering and Accounting to the Item of Depreciation and Ratemaking and for Taxes," was presented by E. E. Bankson. This paper was discussed by Louis D. Blum.

The question of the taxation of both privately and municipally owned water works, as well as their regulation, was discussed by Joseph A. Beck, Attorney at Law, Pittsburgh, Pa., under the title "Should Municipal Plants be Regulated by State Utility Commissions and be Subject to Local, County, State and Federal Taxation?"

"A Review of the Special Lien Bond Situation" was presented by

Robert A. Taft, of Taft, Stettinius & Hollister, Attorneys-at-Law, Cincinnati.

Harry Boggs, of Herdrick & Boggs, Certified Public Accountants, read a paper on "Accounting Uniformity." In the discussion of Mr. Boggs paper, W. S. Patton, Manager of Water Works, Ashland, Ky, stated that the question of a uniform system of accounting has engaged the attention of the A. W. W. A. since 1888, but possibly because no section was formed to consider accounting, little has been done. Mr. Patton urged the A. W. W. A. to supply a uniform system of accounting to its members.

Nathan B. Jacobs and John W. Guilday presented a paper on "The Collection of National Water Works Data." The authors recommended that a statistical engineer be added to the staff of the American Water Works Association whose sole aim and purpose would be the development of water works statistics.

JOINT SESSION OF GENERAL MEMBERSHIP AND WATER PURIFICATION DIVISION

At the joint session of the General Membership and Water Purification Division the progress in abating pollution of water supplies by mine wastes was first presented by E. S. Tisdale, in a paper entitled "Acid Mine Drainage Control on Upper Ohio River Tributaries." This subject was further discussed by the co-author of the paper, E. W. Lyon. The authors believe that, since mine waste pollution is an inter-state problem, such watershed pollution control can best be carried on as a federal project under general federal coördination.

F. H. Waring presented the problem of sealing abandoned mines in the State of Ohio.

Under the title "Long Time Service Records of Wrought Iron and Steel Water Pipes in Buildings in New York City," W. W. Brush gave results of an investigation that had been made under his direction while Chief Engineer of Water Supply of the City of New York, as to the corrosive effect of the city water supply on water pipe systems in forty-seven buildings.

Dr. Frank E. Hale, presented his paper on "Effects of Excess Lime Hydrate Upon the Corrosive Properties of the Soft Catskill Water." Dr. Frank N. Speller discussed this paper.

COMMITTEE REPORTS

A number of progress reports were made by committees. The Committee on Code for The Water Works Industry, W. W. Brush,

Chairman, reported that there appeared to be no likelihood of action being taken in reference to establishing a code for the water works industry and it was recommended that the Committee be discharged.

Committee A-21, Sectional Committee on Specifications for Cast Iron Pipe, T. H. Wiggin, Chairman, reported that work of this committee, which has been going on since 1926, has now reached a point where the work probably can be virtually completed within another year.

The report of the Committee on Uniform Marking of Fire Hydrants, Stephen H. Taylor, Chairman, raised the question as to legal liability of water companies and municipalities if the capacity of hydrants was to be indicated by a color scheme as recommended and this question is now being taken up by the Committee.

The Committee on Licensing Water Works Employees, Lewis V. Carpenter, Chairman, prepared a report which was discussed at length. The report advocated the licensing of water works operators, but the discussion led to the conclusion that the subject would have to be further studied before a final report was submitted. This committee also took up the question of the way in which the A. W. W. A. might be helpful in connection with the water works schools and short courses and steps were taken to have the Association undertake further activity in this field.

The Committee on Federal Income Tax, W. W. Brush, Chairman, reported that there has been an increasing number of municipalities where the Federal income tax on the salary of municipal water works employees had been demanded by the Internal Revenue Bureau. He stated that the tax demanded on his salary as Chief Engineer of Water Supply, New York City, for the year 1931, had been argued in May, 1934, before the Tax Appeal Board at Washington. In the presentation of his case by the Corporation Counsel of New York City, a claim was made for the exemption of the entire salary and also for that portion of the salary that could be attributed to fire protection, street washing and other recognized governmental functions which amounted to about 25 percent. Up to the time of the Cincinnati Convention, this case had not been decided by the Board. It is expected that the City of New York will carry this test case to the United States Supreme Court. In the meantime, it would appear that municipal water works employees would be required to pay the tax on their salaries if and when such a tax was demanded by the Internal Revenue Bureau, but should pay under protest.

Sub-Committee 7-E, Valves, Sluice Gates and Fire Hydrants, G.

Gale Dixon, Chairman of Committee 7, together with W. R. Conard, Chairman of Sub-Committee 7-E, submitted a report setting forth the tentative draft of revised standard specifications. The Committed believes the revised specifications can be acted upon during the coming year.

Committee on Hazards to Plants and Personnel from the Use of Chlorine and Other Chemicals, M. C. Smith, Chairman, submitted a report setting forth the various precautions which could be taken to minimize the hazards resulting from the handling of various chemicals.

DINNER MEETINGS

On Tuesday evening, the high point of entertainment was reached at the All Division Dinner which is the successor to the Water Purification Dinner which had been a feature of Conventions for a number of years past. As usual, Bill Orchard was the master of ceremonies and was assisted by the Water Works Sextet as follows: George Norcom, Ed. Riley, Jack Butler, Joe Wafer, Clinton Inglee and George Haggerter. They were assisted by Ruth H. Best, soloist with the Cincinnati Symphony Orchestra. More than 400 were present and thoroughly enjoyed the excellent program.

On Thursday evening, the dinner dance was held at Hotel Netherland Plaza with some 800 present. Colonel Willard T. Chevalier was Toastmaster. President Jordan presented the John M. Goodell Prize to Frank E. Hale for his paper given last year on the corrosion experiments at the Ashokan headworks, N. Y., and presented the John M. Diven Memorial Medal to Linn H. Enslow, for his activities in the extension of A. W. W. A. interest throughout the United States. President Jordan also presented a certificate of honorary membership in the Association to Denis F. O'Brien and to William Molis.

The winning of the Hill cup by the recently formed Virginia Section was announced, this Section having increased its membership from 25 to 50, representing a 100 percent increase during the past year. The Florida and Pacific Northwest Sections were close contenders for second place, having had an increase in membership of approximately 70 percent. For the first time, the Franklin Henshaw cup was awarded. It was won by the Montana Section for attendance at its annual section meeting of over 90 percent of its membership. The excellent attendance at the various Section meetings was shown by seven other section with percentages ranging between 80 and 90.

ABSTRACTS OF WATER WORKS LITERATURE

FRANK HANNAN

Key: American Journal of Public Health, 12: 1, 16, January, 1922. The figure 12 refers to the volume, 1 to the number of the issue, and 16 to the page of the journal.

Southwest Water Works Journal, Vol. 16, No. 9, 1934. Possibility of Improving Ground Water Supplies by Treatment. CHAS. C. DILLS. 11. Discussion of advantages to be gained by removal of carbon dioxide, iron, manganese, and hardness. Ferric hydroxide precipitated from water containing 4.9 p.p.m. of iron clogged meters; a manganese precipitate accumulated in lead goose-neck connections. (*Courtesy Chem. Abst.*). **Metal Corrosion as Related to Water Pipe.** E. D. KINNEY. 18–20. Good General discussion. (*Courtesy Chem. Abst.*). **Texans Receive Water Supply Operators Information.** L. C. BILLINGS. 22. Water works operators are licensed under three classes, A, B, and C. Requirements for each grade are given. **The Basis for Water Service Charges.** C. KELSEY MATHEWS. 24–26. Principles to be followed in allocating respective costs of different services on an equitable basis are given.—*O. M. Smith.*

Southwest Water Works Journal, Vol. 16, No. 11, 1935. Stream Flow in Missouri During Drought of 1934. H. C. BECKMAN. 4. Greatest deficiency in stream flow occurred in northern and central-western parts of State. **Credit and Collection Department and Methods Used by Water Board of San Antonio, Texas.** G. S. MARBACH. 9–10. This municipal department has for three years cleared their applications for credit through the Retail Merchant Association, making many friends and protecting themselves against loss. **The Water Works, First Line of Defense in Fire-Fighting.** HENRY P. BOHMANN. 11–12. Mainly a discussion of the Milwaukee, Wis., system. **Problems in Feeding Water Works Chemicals.** L. E. HARPER. 13–15. These are largely the problem of selecting proper type of chemical feeding and conveying equipment. Good discussion of dry and solution feeders and of characteristics of the different chemicals used. (*Courtesy Chem. Abst.*). **Tracing Underground Flows of Water with Special Reference to Pollution.** F. M. VEATCH. 18–20. A review of three methods, chemical, electrolytic, and by use of dyes and a discussion of sources of pollution. (*Courtesy Chem. Abst.*).—*O. M. Smith.*

Coagulation of Soil Suspensions by Aluminum and Iron Salts. LLOYD R. SETTER and SANTE MATTSON. Ind. Eng. Chem., 27: 1, 94–7, 1935. Using concentration of 400 p.p.m. of soil colloids, the higher the ratio of oxides of iron and aluminum to silica, the less aluminum chloride was needed to render

them isoelectric at a given pH. Isoelectric precipitation could be produced over a wide pH range. With a minimum of coagulant, aluminum-soil complex will be isoelectric at pH 4.0 and additional coagulant will raise isoelectric pH ultimately to that of pure alumina. With ferric chloride, soil colloids retained a stronger negative charge and pH was lower than with aluminum chloride. With small quantities, flocculation was neither as rapid, nor as complete, with ferric chloride as with aluminum chloride at pH employed.—*Selma Gottlieb.*

Calcium Hypochlorite as a Volumetric Oxidizing Agent. I. M. KOLTHOFF and V. A. STENGER. Ind. Eng. Chem., Anal Ed., 7: 2, 79–81, 1935. Solutions of "H.T.H." calcium hypochlorite, 0.1 and 0.01 normal, were found quite stable if kept in the dark. Available chlorine in a stored sample of the solid, probably over 4 years old, had decreased from 60 per cent to 31.5 per cent. Directions are given for preparation, standardization, and use of hypochlorite solutions.—*Selma Gottlieb.*

Syringe Pipets. AUGUST KROGH. Ind. Eng. Chem., Anal. Ed., 7: 2, 130–1, 1935. Syringe pipets of high accuracy constructed from medical record syringes are described.—*Selma Gottlieb.*

Precise Determination of Oxygen in Water by Syringe Pipets. AUGUST KROGH. Ind. Eng. Chem., Anal. Ed., 7: 2, 131–3, 1935. WINKLER determination of dissolved oxygen in water is performed with 10-cc. sample in syringe pipet. Possible accuracy of method is ± 0.007 ml. of oxygen per liter.—*Selma Gottlieb.*

Photometric Investigation of the Ceruleomolybdate Determination of Phosphate in Waters. REX J. ROBINSON and HENRY E. WIRTH. Ind. Eng. Chem., Anal. Ed., 7: 3, 147–50, 1935. In analysis of natural and sea waters containing normal amounts of phosphate, choice lies between ATKINS (I) and TRUOG-MEYER (II) methods, which use stannous chloride as reducing agent. BELL-DOISY-BRIGGS and FISKE-SUBBAROW methods, using organic reducing agents, are suitable only for extremely large quantities of phosphate. (I) and (II) develop 1.15 times as much color in distilled water as in sea water. With 30-cm. photometer tube, difference ot 0.00001 mg. at. of phosphorus per liter is readily detectable up to 0.0005 mg. at. In higher ranges of concentrations, accuracy is approximately 3 per cent.—*Selma Gottlieb.*

Decomposition of Organic Matter in Sea Water by Bacteria. I. Bacterial Multiplication in Stored Sea Water. SELMAN A. WAKSMAN and CORNELIA L. CAREY. J. Bact., 29: 5, 531–43, 1935. Authors conclude that sea water contains sufficient organic matter in true solution to support, under favorable controlled conditions, an extensive bacterial population. **II. Influence of Addition of Organic Substances upon Bacterial Activities.** Ibid., 545–61. Decomposition of a nitrogen-free organic material, such as glucose, is controlled by amount of available nitrogen present. Tentative explanation is suggested for stability and uniformity of organic matter in sea water, based on specific relationship of bacteria to animal population of sea, and on presence, under natural con-

ditions, of factors unfavorable to rapid bacterial development.—*Selma Gottlieb.*

Studies in the Escherichia-Aërobacter Intermediates. I. Cultural Characteristics. RALPH P. TITTSLER and LESLIE A. SANDHOLZER. J. Bact., 29: 4, 439-61, 1935. Study of cultural characteristics of 29 methyl-red positive and VOGES-PROSKAUER negative Escherichia-Aërobacter "intermediate" strains isolated from soil and water showed a heterogenous group. Not all members could be differentiated by any single characteristic from both the above genera, but authors believe group should be allocated to Escherichia genus.—*Selma Gottlieb.*

The Fermentation of Alpha-Methylglucoside by Bacteria. RALPH P. TITTSLER and LESLIE A. SANDHOLZER. J. Bact., 29: 4, 363-8, 1935. Ability to ferment α-methylglucoside was determined for 730 bacterial cultures representing 19 genera and over 60 species. Few species were able to attack the glucoside, but all Aërobacter cultures and about one-third of Escherichia-Aërobacter "intermediates" produced acid and gas. No "typical" Escherichia showed evidence of fermentation. Relation of α-methyl-glucoside fermentation to other differential characteristics of group, significance in distinguishing "intermediate," or type, species and value of this characteristic as aid in separation of certain closely related Proteus cultures are discussed.—*Selma Gottlieb.*

Evidence on the Specificity of Hexosidases. A Comparison of the Activity of Escherichia Coli and Escherichia Communior. MARGARET HOTCHKISS. J. Bact., 29: 4, 391-8, 1935. Specificity of maltose and sucrose was demonstrated. Seven preparations from *E. coli* were active for maltose, but not for sucrose. Of *E. communior* preparations, 5 were active for sucrose alone, 6 for maltose alone, and 5 for both Sugars. Details of technique are described.—*Selma Gottlieb.*

The Significance of Marine Bacteria in the Fouling of Submerged Surfaces. CLAUDE E. ZOBELL and ESTHER C. ALLEN. J. Bact., 29: 3, 239-51, 1935. Bacteria and, to lesser extent, other microörganisms are the primary film-formers on submerged glass slides. Such films favor subsequent attachment of larger and more inimical fouling organisms.—*Selma Gottlieb.*

Bactericidal Action of Azochloramid (N-N-Dichloroazodicarbonamidine). FRANZ C. SCHMELKES and ELIZABETH S. HORNING. J. Bact., 29: 3, 323-31, 1935. Azochloramid was much more effective than sodium hypochlorite or chloramine-T as bactericidal agent in presence of organic matter such as serum. Only actively reducing organic matter, such as hemoglobin, impaired its efficiency. It shows very little specific action and is effective against various kinds of organisms.—*Selma Gottlieb.*

Bacterial Variation with Special Reference to Behavior of Some Mutabile Strains of Colon Bacteria in Synthetic Media. I. M. LEWIS. J. Bact., 28:

6, 619–39, 1934. Eleven strains of colon bacteria were studied. Sugars and alcohols were found to act as selective agents for variation and not to exert specific inciting stimulus. Variant cells were always present in plain agar colonies, but in such small numbers as to escape detection by conventional methods. They were determined by means of densely seeded agar of appropriate formula. Secondary colonies are formed on synthetic agar containing the appropriate carbon compound and are due to food depletion and beneficial variation. Enhancement of fermentation by serial transplants depends on building up number of variant cells. Variation in colony form in aërobacter strains is not correlated with variation to lactose.—*Selma Gottlieb.*

Oxidation-Reduction Potentials and Ferricyanide Reducing Activities in Peptone Cultures and Suspensions of Escherichia Coli. C. E. CLIFTON, J. P. CLEARY, and P. J. BEARD. J. Bact., **28**:6, 541–59, 1934. Marked fall in potential occurs during period of rapid growth and maximum reduction potential is developed in, or near, maximum growth period in stationary cultures. Both potential and maximum viable count are maintained quite constant in continuous flow cultures. Concentrations of peptone, organisms, and ferricyanide play closely connected rôles in controlling metabolic activities which are believed from data to give rise to the oxidation-reduction potentials.—*Selma Gottlieb.*

Oxidation-Reduction Potentials and Ferricyanide Reducing Activities in Glucose-Peptone Cultures and Suspensions of Escherichia Coli. C. E. CLIFTON and J. P. CLEARY. J. Bact., **29**:6, 561–9, 1934. Fall in potential during period of rapid growth is more marked and reducing intensity is higher in glucose-peptone cultures of *E. coli* than in plain peptone. Maximum viable population is also higher and is maintained under favorable conditions in continuous flow cultures. Concentration and nature of substrates and oxidants and concentrations of organisms play closely connected rôles in controlling metabolic activities of cells, as measured by ferricyanide reduction. Maltose, glucose, and lactose are readily oxidized by ferricyanide in suspensions of "resting" *E. coli*. Data suggest that ability of coli to utilize these sugars decreases, as E_h of oxidant increases.—*Selma Gottlieb.*

Studies of Certain Factors Influencing the Size of Bacterial Populations. J. P. CLEARY, PAUL J. BEARD, and C. E. CLIFTON. J. Bact., **29**: 2, 205–13, 1935. *E. coli* was used as the test organism in apparatus for studying growth under constant flow conditions. Physical crowding and formation of specific growth-inhibiting substances are not important factors in restraining bacterial growth. Effect of metabolites is variable. Growth ceases because of changes in the availability of nutrient material and energy demand, and will not rise above a certain point even when effect of metabolites is reduced to a low level. —*Selma Gottlieb.*

Comparative Studies of Presumptive Test Media for the Coli-Aërogenes Group of Bacteria. I. V. SHUNK. J. Bact., **29**: 2, 163–72, 1935. Using small inocula, 201 strains of freshly isolated human fecal Escherichia, Aërobacter, and

Citrobacter all gave positive tests in lactose broth and brilliant-green lactose peptone bile after 24 hours incubation at 37°C. Only 49 percent of these strains were positive in crystal-violet broth and very few in fuchsin broth. With relatively large inocula, only 33 of the 201 strains formed gas in 48 hours in fuchsin broth. A greenish fluorescent water bacterium was isolated which enabled dye-sensitive *E. coli* strains to produce gas in crystal-violet broth within 48 hours.—*Selma Gottlieb.*

The Morgan Bacillus. EDWIN O. JORDAN, ROBERT R. CRAWFORD, and JOSEPHINE MCBROOM. J. Bact., 29: 2, 131–48, 1935. Many type culture strains labelled as Morgan bacillus do not agree in significant cultural characteristics with generally accepted criteria for the group. Cultural and antigenic characters seem to relate Morgan bacilli nearly to *B. coli.* They may be reasonably regarded as ill-defined division of *B. meta-coli.* For man, they are somewhat more pathogenic than "slow lactose fermenters" or true *B. coli.* In author's experience, freshly isolated fecal strains with "Morgan bacillus" characteristics have come only from persons suffering some form of gastro-intestinal derangement.—*Selma Gottlieb.*

A Comparison of the Maximal Growth Rates of Various Bacteria under Optimal Conditions. M. M. MASON. J. Bact., 29: 2, 103–10, 1935. Table is given of growth rates, expressed as generation times, for various species of bacteria, as reported in the literature. Different species show decided differences in growth rate, in many cases characteristic of the genus.—*Selma Gottlieb.*

The Health Hazards of Cross-Connections in Buildings. Health News (N. Y. State Dept. of Health), 10: 48, 189, November 27, 1933. Division of Sanitation is studying possible dangers of pollution of water supplies within buildings by back-siphonage and drainage from and through plumbing and similar fixtures. Purpose of study is to ascertain to what extent fixtures establishing connections between water and sewer lines are in use; to establish specifications which should be met in all new installations; and to develop economical methods or devices whereby water and sewer connections to existing fixtures may be satisfactorily protected. Special attention has been given to hospitals and similar institutions.—*G. C. Houser.*

Steps Taken at Buffalo Conference to End Niagara River Pollution. Health News (N. Y. State Dept. of Health); 10: 49, 193, December 4, 1933. Problem of ending pollution of Niagara River by untreated sewage from cities of Buffalo, Tonawanda, North Tonawanda, and Niagara Falls, and resulting menace to public water supplies derived from this stream was discussed by local officials at conference in Buffalo in November, 1933. Three proposed solutions were considered: (1) revamping internal sewer system of Buffalo and interception and treatment of Buffalo sewage; (2) formation of a Niagara-Metropolitan Sewerage District; (3) treatment of sewage of the four cities at four separate plants and extending water intakes to points beyond influence of sewage from cities involved.—*G. C. Houser.*

Highways and Water Control. Ohio Health News, 10: 14, 2, July 15, 1934. State highway system covers 26,118 acres of Ohio soil, and in a general rain of one inch over entire system sheds 713 million gallons of water through ditches into the streams to be run off to the sea. At the Ohio yearly average of approximately 37.5 inches of rainfall, this run-off rises to stupendous figure of 26,730 m.g. Highways cannot be given up; but ditching of streams and stripping their banks of trees and underbrush should be under most careful regulation.—*G. C. Houser.*

"Alarm System" to Protect Water. Pennsylvania's Health, 12: 4, 23, July–August, 1934. Water consumers along Beaver River are now being protected from pollution of public water supply through discharge of phenol wastes from by-product coke plants, through coöperation between health departments of Pennsylvania, Ohio, and West Virginia. When an accident occurs at a phenol-elimination plant, allowing phenol to contaminate water of adjacent stream, plant notifies health department which, in turn, immediately advises health departments in the other states through which affected stream flows. This advance warning enables water-works authorities to throw in service their emergency remedial measures.—*G. C. Houser.*

Typhoid in Hardin County. Ohio Health News, 10: 16, 2, August 15, 1934. Five cases of typhoid fever were recently found in Ohio onion fields. Many wells in this territory are badly polluted, and families affected persist in drinking the water without boiling it. Water from an open polluted ditch was responsible for one at least of cases referred to.—*G. C. Houser.*

Tennessee Obtains Water and Sewerage Improvements Under PWA Program. Health Briefs (Tenn. Dept. of Public Health), 11: 9, 2, September 15, 1934. Up to August 1, 1934, 16 water works projects and 10 sewerage projects have been approved by PWA and funds have been allotted for their construction. These 26 projects are, for the most part, complete new water works and sewerage systems and include 19 towns and cities. Estimated cost of approved projects totals $2,250,000. Aggregate 1930 population of the 19 towns and cities is 450,000. Besides the 26 projects approved, applications were submitted covering 23 additional water or sewerage projects, which are still pending and are estimated to cost a total of $1,372,000.—*G. C. Houser.*

Bottled Water Must Be Clean. Weekly Bulletin, Cal. Dept. of Public Health, 13: 33, 131, September 15, 1934. Los Angeles Dept. of Water and Power recently took samples of water in office buildings. Both city water and bottled water were analyzed, and bottled samples averaged 1725 bacterial count per cc., as against 55 for city water. Latter is under constant chemical supervision, and bottled water should likewise be supervised, and chemically and bacteriologically tested.—*G. C. Houser.*

Water-Bill Payments Legitimate Relief. Ohio Health News, 10: 20, 3, October 15, 1934. In recent opinion of Attorney General, question of delinquent water bills is discussed. Payment of water bills of indigent persons

having legal settlement within city is declared to be a type of "relief" authorized by Ohio statutes. There is no authority, however, for city to furnish free water directly to indigent persons. State Relief Commission may grant funds from State Emergency Relief Fund for such purpose. In cases where indigent tenant is in arrears in his water bill and where contract for water service is between city and non-indigent property owner, it is held that there is no authority for payment of water bills from poor relief funds.—*G. C. Houser.*

New Program for Water Supply Control. C. R. Cox and F. W. GILCREAS. Health News (N. Y. State Dept. of Health), **11**: 43, 170, October 22, 1934. In New York there are about 678 public water supplies, of which approximately 50 percent serve communities with populations less than 1,000. Water purification is provided for about half of public supplies in State. Only about 75 municipalities provide expert laboratory supervision of public water supplies, or employ consulting chemists for periodic advice. Arrangements have recently been made by State Department of Health for new program of periodic examination of samples from supplies throughout the State. Supplies are being samples two to six times a year, depending upon need for such supervision.—*G. C. Houser.*

The Menace of the Abandoned Well. Wisconsin State Board of Health Bulletin, **5**: 20, 25, October–December, 1934. Using abandoned well for purposes of waste disposal is sure method of inviting trouble, owing to peculiarities of Wisconsin's geological formations. Recently Bureau of Sanitary Engineering, by means of dye solution, traced pollution of city-owned well to abandoned private well a few hundred yards away, which was being used for disposal of household wastes. Only certain method of rendering abandoned well harmless to adjacent water supplies is to fill the shaft with cement grout to ground surface.—*G. C. Houser.*

Water Shortage in 1934 Bad as Three Years Ago. Ohio Health News, **10**: 23, 3, December 1, 1934. After unprecedented drought of 1930, it was generally predicted that drought of similar nature would not occur again for a generation. However, in 1934, drought occurred which, in so far as its effect on public water supplies in Ohio is concerned, was in many instances more severe than that of 1930. It is known that water shortages occurred during 1934 in about 40 municipalities of the State; probably other cities and villages also suffered similar experiences.—*G. C. Houser.*

Domestic Water Supplies. Weekly Bulletin, California Department of Public Health, **13**: 44, 173, December 1, 1934. Proper construction of wells and reservoirs in connection with domestic water supplies is important in districts where municipal supplies are not available. In special bulletin pertaining to rural sanitation, issued by California State Department of Public Health, essential provisions for safe domestic water supplies are outlined under following headings; cased wells, dug wells, springs, surface waters, water tanks, and tastes. Damage by dead animals or decaying matter in a well is best dealt with by removing the cause and pumping out well until water becomes palat-

able. A pound of chloride of lime, or a pint of soluble kitchen clorox or luxol, per 15,000 gallons of water is a good disinfectant.—*G. C. Houser.*

What Means Sanitation? L. A. GEUPEL. Monthly Bulletin, Indiana Division of Public Health, **37**: 12, 185, December, 1934. Practice of good sanitation and sanitary measures may be called the science of placing elementary problems of cleanliness and consideration for others into universal economical use. Lack of public foresight permits 1377 miles of streams and rivers in Indiana to be so polluted that they must be regarded as unfit for use and recreation. Classification of the pollution shows: 690 miles of raw sewage from cities; 294 miles of coal-mine drainage wastes; and 164 miles of cannery wastes. Bordering on these polluted waterways, there are 17 municipalities with a population of 966,000 which must take this polluted water, treat it, filter it, sterilize it, and then use and drink it. Everyone in Indiana is urged to consider elimination of gross stream pollution in the state in order to maintain healthful living conditions.—*G. C. Houser.*

Bureau of Sanitary Engineering. News Items. Monthly Bulletin, Indiana Division of Public Health, **37**: 12, 190, December, 1934. In study of rainfall records, bureau finds that Indiana had deficiency of about 6.5 inches up to end of October, 1934. With normal rainfall of 40 inches per year, entire state had water deficiency of 16.2 percent. Extreme southwestern part of state had sufficient rainfall, while south central, central, and northern sections "burned up" during crop growing season. This statement is upheld in record of Indianapolis section, which showed deficiency of 13.5 inches of rainfall, or 34 percent. Two new municipal water-filtration plants were placed in service, namely Huntingburg and Petersburg. In Marion County, out of 42 school water supplies examined in laboratory, six were found unsatisfactory.—*G. C. Houser.*

New Water Works Systems for Many Ohio Villages. Ohio Health News, **11**: 2, 3, January 15, 1935. In 50 Ohio Villages, public water works systems have been installed, or put under way, during last two years, or are about to be installed. With five exceptions, these systems have been undertaken as P.W.A. projects. Ashville, Oak Hill, Proctorville, and Richwood projects include plants for removal of iron from well water; Pemberville project includes plant for softening well water. Only project that proposes use and purification of surface water is at Williamsburg. Total population of these 50 villages is 46,737. With these systems installed, there will remain only 18 Ohio villages of more than 1000 population unprovided with public water supplies.—*G. C. Houser.*

Methods and Purposes of Shooting Wells. P. F. LEWIS. Southwest Water Works J., **16**: 12, 11–15, 1935. Excellent general discussion of explosives, and of economies and results to be expected.—*O. M. Smith.*

Comparative Notes on Field Joints for Large Diameter Steel Pipe. W. C. CURD. Water Works and Sewerage. Part 1. **81**: 12, 397–402, December, 1934. Article describes installation of 42-inch steel supply main at Fort

Wayne, Ind., including practical field methods for laying and jointing, labor-distribution, field-coating, etc. Based on varied and long experience in laying large diameter steel pipe lines, author cites practical comparisons between several types of joints previously employed and the Dresser type used on the Fort Wayne project. **Part II.** Ibid., **82**: 1, 16–19. January, 1935. Additional experiences on Fort Wayne project, including methods and results of leakage tests, method of river crossing, and other unusual features.—*R. E. Noble.*

Benefits Resulting from Plant Beautification. EDWARD H. RUEHL. Water Works and Sewerage, **82**: 1, 27–30, January, 1935. Benefits and procedure discussed.—*R. E. Noble.*

Court Decision on Public Health. Public Health Reports, **49**: 49, 1485. December 7, 1934. (Illinois Supreme Court; Barrington Hills Country Club et al. *v.* Village of Barrington, 191 N. E. 239; decided June 15, 1934.) Riparian owners sought injunction to prevent Village of Barrington from discharging sewage and sewage-treatment effluent into creek above their premises. Trial court held, and Supreme Court sustained, in favor of complainants. Court opinion given.—*R. E. Noble.*

New Rate Controller for Filter Plants. E. FRANK STOVER. Water Works and Sewerage, **81**: 9, 310–312, September, 1934. Requirements for controller, and advantages from departure in valve location, discussed. Two charts of test results.—*R. E. Noble.*

Quality of Los Angeles Water Supply. R. F. GOUDEY. Water Works and Sewerage, **81**: 9, 297–299, September, 1934. Discussion covers:—(1) sources, (2) tables showing mineral, bacteriological, and sanitary chemical quality of aqueduct water, and (3) chlorination. Author reports success with chlorine-ammonia treatment.—*R. E. Noble.*

Biological Methods of Sewage Treatment Identified with Water Softening. Public Health Reports, **50**: 5, 143–144, February, 1935. Public Health Service studies of organic matter adsorption from sewage by so-called "activated" sludges have led to definite identification of the active adsorbent principle as a base-exchanging substance chemically identical with zeolites of water purification. Process of removing organic matter from sewage by biological slimes or activated sludges, therefore, becomes basically the same as corresponding process of removing hardness and other objectionable constituents in a widely-used process of water purification. Detailed information will be contained in series of Public Health Service papers, soon to be published, which will review theories of sewage clarification and will reach the conclusion that adsorbent principle is related, not to bacteria themselves, but to gelatinous matrix, or sludge, in which they are embedded. It will next be shown by chemical analysis that inorganic portion of the gelatinous matrix is definitely a zeolite. Behavior of activated sludge will be shown to conform rigidly to action of a zeolite. Sterilized sludge, for example, can be regenerated by sodium chloride,

in exactly same manner as commercial zeolites. Under natural conditions, however, regeneration of the sludge is technically called "reactivation," with bacteria as active agents instead of sodium chloride. Natural sludge is, therefore, termed a "bio-zeolite." In conclusion, the clotting enzyme, or sewage colloid of the earlier chemists, will be identified with the sludge zeolite. —*R. E. Noble.*

The Occurrence of Infestation with E. Histolytica Associated with Water-Borne Epidemic Diseases. A. V. HARDY and BERTHA KAPLAN SPECTOR. Public Health Reports, **50**: 10, 323–334, March 8, 1935. During stockyards fire in Chicago in May 1934, water heavily polluted with fresh sewage was used for drinking purposes by many firemen and spectators. There followed a large but undetermined number of cases of acute diarrhea, 69 of typhoid fever, and 2 of paratyphoid. Laboratory studies revealed that a high percentage of those exposed had become infested with *E. histolytica*; and the more severe the symptoms, the higher the percentage. Six cases of undoubted amoebic dysentery, two with complicating liver abscess, were recognized among those exposed. Six other mild cases (1 fireman and 5 spectators) were also diagnosed as amoebic dysentery and reported to the board of health. Evidence has led to the opinion that many other illnesses with intestinal symptoms were also the result of *E. histolytica* invasion. It is therefore concluded that infestations with *E. histolytica* may occur in association with water-borne epidemic diseases, and, furthermore, that control of amoebic dysentery demands that water for human consumption be free from dangerous protozoal, as well as bacterial, contamination.—*R. E. Noble.*

Municipal Water Works Made Attractive to the Public. Anon. The American City, **50**: 1, 46–48, January, 1935. Value of municipal water works of Columbus, Ga., to public has been impressed on citizens of that city by recreational facilities provided there. Picnic grounds, barbecue pits, and stone ovens on the landscaped and beautified plant area are available for use within certain necessary limits. Highly turbid raw water, from Chattahoochee River, freed from sand by catch-pit, passes to low-lift suction well from which it is discharged by three pumps into concrete-lined storage reservoir which is particularly useful in leveling off high turbidity peaks. From reservoir, water passes to mixing channels, where alum and lime are added, and then to coagulating basins. At end of first mixing chamber, air is introduced through Filtros plates in floor to remove tastes and to increase dissolved oxygen. Coagulation is followed by rapid filtration and chlorination. Plant is equipped with complete laboratory facilities.—*Arthur P. Miller.*

Aëration and Filtration of a Deep-Well Water Supply. Anon. The American City, **50**: 1, 51–52, January, 1935. Hattiesburg, Mississippi, has planned its water works for future extensions. Space in buildings is available for additional apparatus and a deep well not now needed for public water supply is available. Ten deep wells, only two of which must be pumped, supply water to a collecting basin from which low-lift pumps move it to aërator of coke tray type. From this point it flows to rapid sand filters and then to clear water

reservoir. It has not been necessary to coagulate the water before filtration nor to disinfect it after.—*Arthur P. Miller.*

Cleaning Reservoir Feeder Mains. ROGER W. MACDONALD. The American City, 50: 1, 54–55, January 1935. Insufficient discharge through three-mile gravity line at Peabody, Massachusetts, indicated need for cleaning. Line, consisting of 1 mile of 24-inch cast iron pipe and 2 miles of 20-inch, was successfully cleaned without difficulty. Special problems presented by cleaning of another 3500-foot line of 20-inch pipe were all met.—*Arthur P. Miller.*

Chlorinated Copperas Treatment of a Low Alkalinity Surface Water. Anon. The American City, 50: 2, 49–50, February 1935. Alabama Water Service Company supplies several small towns having total population of 8700 from their plant at Chickasaw, Alabama. Water of Eight Mile Creek, the source of supply, is of low alkalinity and copperas, applied at rate, under normal conditions, of 1 grain per gallon is coagulant used. This is followed by chlorine and at the three-quarter point of the coagulating basin, lime is added, more of which can be added in the clear well, if necessary, in order to bring the pH to 7.2. Pumps, filters, and storage tank are described.—*Arthur P. Miller.*

New Bedford, Massachusetts, Completes New Concrete Supply Line. Anon. The American City, 50: 2, 57–58, February 1935. A 48-inch riveted steel asphalt-coated force main laid in the New Bedford, Massachusetts, system in 1896–9 was so pitted that a second line parallel to it was started and about 4 miles of new 48-inch cast iron pipe was laid from time to time by water department. Recently, with P.W.A. aid, steel-cylinder-reinforced concrete pressure pipe, made near the job, was installed under contract. Methods of manufacturing and laying this pipe are described.—*Arthur P. Miller.*

City Water Supply from Bottom of 100-Foot Shaft. Anon. The American City, 50: 3, 51–52, March 1935. Water supply of Tallahassee, Florida, derived from four small driven wells, has now been augmented by construction of a single 22-inch well, pumps for which are at bottom of 100-foot shaft. Pump room, 11 x 13 feet, at shaft bottom houses a 2-stage, 6-inch Worthington volute unit and necessary fittings, by means of which water is forced through 12-inch riser to 400,000-gallon tank 200 feet above ground level. Air in pump room is kept fresh by blower and waste water which collects in 400-gallon sump is forced out with an automatically controlled 45-g.p.m. Allis-Chalmers pump. New tank is modification of design received in national tank design contest held a few years ago.—*Arthur P. Miller.*

Parker Dam to Furnish Water for Thirteen California Cities. KING HAMILTON GRAYSON. The American City, 50: 3, 59–60, March 1935. Brief description of this large project designed to bring water from Colorado River to Los Angeles and 12 other neighbouring communities.—*Arthur P. Miller.*

Meters Tell the Story. Anon. The American City, 50: 4, 49–51, April 1935. In Griffin, Ga., the electric side of the filtration and pumping plants is so

metered that various electric costs can readily be obtained. Likewise on the water side, meter records show not only what water is used at the plant, but also 100 percent of that flowing into city connections. Hence, in this city, it is not a task to produce accurate and business like consumption figures. A modern pumping station, secured against flood hazards, lifts water from Flint River to rapid sand filtration plant, where chemical application, mixing, coagulation, and filtration take place, while in basement is located the high-lift pumping station, which moves the filtered water to two elevated storage tanks. Laboratory facilities are provided.—*Arthur P. Miller.*

Municipal Utilities Pay City's Way for Third Year. Anon. The American City, **50**: 4, 58–59, April 1935. Water and electric plants in Huntingburg, Indiana, have paid the city's way for the third successive year, besides putting a tidy sum on deposit. Plants are highly efficient, due probably to fact that present superintendent has been on the job for 17 years. Rates are low enough to permit minimum as well as maximum consumption. Marginal power is sold.—*Arthur P. Miller.*

A "Reasonable Rate of Return" to Water Companies. Anon. The American City, **50**: 4, 60, April 1935. "There is no fixed standard ... of what is a fair rate of return for the utility industry. Such rate of return must depend upon local and general economic conditions existing at the time, and any special conditions pertaining to the company the rates of which are being investigated."—*Arthur P. Miller.*

External Protection of Metal Pipes by Cement Mixtures. "Dalmine" Covering. A. Rocca. Mém. compt. rend. soc. ing. civils France, **86**: 890–921, 1933. From Chem. Abst., **28**: 2149, April 10, 1934. Advantages of cement for external protection of metal pipes against corrosion are brought out, and also difficulties of its application in practice. Latter are claimed to have been practically overcome by use of "Dalmine," a coating consisting of asbestos and cement, proportions and grade of materials varying according to conditions of use. Manufacture of coating and application to piping are described.—*R. E. Thompson.*

Corrosion of Steel and Physico-chemical Tests Carried Out on "Dalmine" Covering. O. Scarpa. Mém. compt. rend. soc. ing. civils France, **86**: 922–65, 1933; cf. preceding abstract. From Chem. Abst., **28**: 2149, April 10, 1934. Mechanism of corrosion of iron and steel piping in ground and factors affecting it are discussed, and various physico-chemical tests carried out on "Dalmine" to determine its value as protection for piping are described. Tests include electrolytic estimation of porosity, macro- and micrographic examination of structure, determination of specific electrical resistance (as applied to pipe after subjection to appropriate voltage for periods up to 12 months or more), ability to induce or maintain apparent or real passivity of iron, resistance to action of water and of aqueous salt solutions, free lime content, and amount of lime that can be removed by water or aqueous salt solutions. Results of these tests and of examinations of Dalmine-protected pipe that had been ex-

posed to very severe corrosive conditions showed product to be highly satisfactory.—*R. E. Thompson.*

Treatment of Flood Waters in Bradford Field for the Removal of Corrosive Suspended Matter. L. J. CLARKE. Oil and Gas J., **32**: 34, 16, 18, 1934. From Chem. Abst., **28**: 2442, April 20, 1934. Lime is added to water to form calcium carbonate which forms protective coating on interior of pipes.—*R. E. Thompson.*

The Action of Water on Concrete. B. KELLAM. Proc. Am. Soc. Testing Materials, **33**: Pt. I: 289–96. 1933. From Chem. Abst., **28**: 2150, April 10, 1934. Literature is reviewed and summary of present knowledge presented. Action of water on concrete is fundamentally solvent action upon lime set free by hydrolysis of cement. Degree of solvent action is dependent primarily upon carbon dioxide content of water and to lesser extent upon soluble sulfates and other dissolved substances. Complete chemical analysis of water is necessary before any significance can be attached to pH value. Experimental data on variation of lime content with pH value of river waters are presented. Seven references.—*R. E. Thompson.*

Consolidation and Waterproofing, by Means of Water Glass, of Fissured or Disintegrated Rocks. M. STAMATIU. Ann. mines Roumanie, **15**: 277–80, 323–6, 1932; **16**: 301–6, 1933; Chimie et industrie, **30**: 1337. From Chem. Abst., **28**: 2152, April 10, 1934. Only alkali silicates and silica are suitable for chemical consolidation and waterproofing of porous, fissured, or disintegrated rocks, to stop infiltration of water or saline solutions, Crushing strength of chemically consolidated rocks depends on size of grain of rocks (decreasing with increase in grain size), specific gravity, petrographic nature, time of air-drying of the solutions (strength increasing with time of drying), their nature and concentration Alkali silicate solutions give best results when used at maximum concentration, but in practice this is limited to 36–38° Bé., above which viscosity decreases their penetrative power.—*R. E. Thompson.*

A Practical Method of Electrical Protection for Pipe Lines Against Soil Corrosion. STARR THAYER. Natural Gas, **14**: 11, 6–12, 1933. From Chem. Abst., **28**: 2309, April 20, 1934. Line laid in 1927 protected with one coat of coal tar enamel was examined in 1932 and found seriously corroded. Methods and results are described of electrical protection system that was then put into operation. Conclusions: (1) current of 0.6 volt is sufficient to give complete protection; (2) it would not be economical to attempt protection of bare line by this method. Also in Proc. Am. Petroleum Inst., 14th Ann. Meeting, Sect IV, 143–52, 1933.—*R. E. Thompson.*

Studies of the Effect of a Small Impounding Reservoir on Stream Purification. G. M. RIDENOUR. Sewage Works J., **5**: 319–32, 1933. From Chem. Abst. **28**: 2437, April 20, 1934. Seasonal studies are compared to show effect of small impounding reservoir on purification of comparatively heavily polluted stream. These studies show that biochemical oxygen demand reduction

through reservoir amounted to 66.5 percent in summer as against 52.5 in winter. Average detention periods were 2.8 and 3.0 days, respectively. Average reduction of *Es. coli* amounted to 76 percent in summer and 40 percent in winter. Coefficients for rate of deoxygenation and reaëration of pond with respect to STREETER'S formulae for deoxygenation of sewage-polluted water under conditions of reaëration are determined. Of 13.5 p.p.m. oxygen consumed through pond in summer, 10.4 was furnished by atmospheric absorption and photosynthetic processes. This amounted to 466 pounds per day. During winter, 9.8 p.p.m. was furnished by these processes, equivalent to 407 pounds per day or 87 percent of that provided in summer.—*R. E. Thompson.*

The Detection of Nitrite in Water. M. MONTALTI. Diagnostica tec. lab. (Napoli) R iv. mensile, **4**: 488–92, 1933. From Chem. Abst., **28**: 2438, April 20, 1934. The ZLATAROFF (C. A., **17**: 2928), VERGNOUX (C. A., **23**: 3037) and RAVENNA (Analisi Chimica, C. A., **16**: 2095) reactions for detection of nitrite have been compared. Sensitivities found in grams per liter, respectively, were: 5×10^{-5}, 5×10^{-4}, and 5×10^{-7}. Last named method is therefore to be preferred. Reagent is prepared by mixing solutions **A** and **B**. Addition of 5 drops of reagent to 100 cc. of sample gives rose coloration in dilute, and orange coloration in more concentrated (5×10^{-2} gram per liter), solutions of nitrite. Solution **A** = 0.5 gram sulfanilic acid in 150 cc. 10 percent acetic acid. Solution **B** = 0.2 gram α-naphthylamine boiled in 150 cc. 10 percent acetic acid, followed by addition of 20 cc. water.—*R. E. Thompson.*

The Manufacture of Artificial Zeolites. The Control of Zeolite Water Softeners. PAUL G. BIRD. Iowa State Coll. J. Sci., **8**: 183–5, 1933. From Chem. Abst., **28**: 2439, April 20, 1934. Optimum proportions for artificial zeolite were $SiO_2:Al_2O_3::2.2:1$. Maximum capacity was obtained when gel was made to contain about 1.25 gram molecules of alumina per liter. Gel was filter-pressed, frozen at 21°F. for 48 hours, dried at room temperature, and tested for capacity. Freezing increased the capacity, as did addition of small amounts of sodium carbonate, agar, casein, or sodium hydroxide. Addition of small amounts of sodium chloride, trisodium phosphate, or borax, or of large amounts of glue, casein, or sodium carbonate, cause decrease in capacity. Automatic control of regeneration of zeolite softeners could be effected by making use of greater conductivity of softened water or of light-sensitive control activated by lines which appear in hard water but not in softened waters.—*R. E. Thompson.*

Water Pollution Research. A. PARKER. Munic. Eng. Sanit. Record, **92**: 688–9, 1933. From Chem. Abst., **28**: 2446, April 20, 1934. Solvent action of many natural waters on lead service pipes, with resulting contamination, is briefly discussed.—*R. E. Thompson.*

Water from Coke Chemical Plants. P. I. KOTLIAROV. Coke and Chem. (U.S.S.R.), **1932**, 12, 13–21. From Chem. Abst., **28**: 2446. April 20, 1934. Treatment of water from coke and coke by-products plants in European and United States practice is described.—*R. E. Thompson.*

Profiting by the Gas Companies' Experience. Eng. and Cnt. Rec., 48: 278–9, April 4, 1934. Advantages of Dresser pipe couplings, leak clamps, and fittings are described.—*R. E. Thompson.*

Metallizing to Prevent Corrosion and Overcome Rust. C. J. POTT. Eng. Contract Record, 48: 277–8, 1934. Metallizing is a process for spraying pure metal on practically any metallic or non-metallic surface without use of acid or flux and without preheating of object to be coated. Coating can be built up to any reasonable thickness and can be filed, ground, or polished. Application is effected with gun in which the metal in form of wire is melted by oxyacetylene flame and blown by compressed air at high velocity. Porous surface can be coated without any preparation, but metal surfaces must be first roughened by sand or steel-grit blasting. Applications of the process are summarized.—*R. E. Thompson (Courtesy Chem. Abst.).*

Directory of Important Water Works Systems of Canada. Eng. Contract Record. 48: 290–304, April 4, 1934. Authoritative and up-to-date data, alphabetically arranged by provinces, are given concerning the water supplies of leading cities and towns of Canada.—*R. E. Thompson.*

Improved Water Supply for Burlington, Ontario. Eng. Contract Record, 48: 372–3, May 2, 1934. Brief data given from report submitted to Water Commission by H. G. ACRES and G. H. POWERS recommending construction of new intake, low-lift pumping station, gravity filter plant, and high-lift station at estimated cost of $149,000. Intake, 16 inches in diameter, extending 2500 feet into Lake Ontario, and the low-lift station would have capacity of 1.5 m.g.d. Three 350-g.p.m. filters would be ample for present requirements.—*R. E. Thompson.*

Severe Winter Gives Prominence to Welding Generators as Pipe Thawing Equipment. VINCENT R. YOUNG. Eng. Contract Record, 48: 491, June 6, 1934. Attention is drawn to fact that arc-welding generators are particularly well suited for thawing frozen services.—*R. E. Thompson.*

Photo-electric Method of Chlorine Gas Control at the Montreal Filtration Plant. C. J. DESBAILLETS. Eng. Contract Record, 48: 641–3, 1934. Brief description of two photo-electrically-controlled chlorinating machines recently installed at Joseph St. filtration plant in Montreal, flow of chlorine through which is automatically adjusted in accordance with residual chlorine content of treated water. Two similar units were installed in 1931. Equipment has also been provided for recording amount of chlorine used and residual chlorine content of treated water after 10-minute contact period.—*R. E. Thompson (Courtesy Chem. Abst.).*

Inadequacy of Water Supply Subject of Law Suit. Eng. Contract Record, 48: 538, June 27, 1934. Suit for $919 damages against Suburban Water, Limited, alleging that inadequate water pressure at summer home caused much additional work, inconvenience, worry, and mental affliction, resulting in

breakdown in health of housewife, was dismissed in Superior Court of Quebec recently. While the weight of evidence was that supply of water was inadequate, court concluded that plaintiffs had failed to show any liability on part of company, and that, even if such responsibility had been shown, the damages suffered were too remote to render company liable.—*R. E. Thompson.*

Testing Turbine-Driven Pumps for Calgary Water Supply. Eng. Contract Record, **48**: 643–4, July 25, 1934. Brief details given of method employed in testing turbine-driven pumps at new Calgary water works. Differential water manometer, installed to read loss in pressure between reservoir and inlet to turbines, was calibrated by salt titration method and discharge of turbines then read directly from manometer. Overall efficiency of pumping units was 78.7 percent, slightly above that guaranteed.—*R. E. Thompson.*

A New and Ingenious Method for Cleaning and Relining Water Pipes in Place. S. A. McWilliams. Eng. Contract Record, **48**: 274–6, 1934. Illustrated description of the "Eric" process of cleaning and relining water mains *in situ*. After scraping and cleaning, main is filled with colloidal solution of bitumen and latter is deposited on the metal by means of an electrode drawn through the main in stages. When the deposited bitumen reaches a certain thickness it acts as an insulator, preventing the passage of current and further deposition; attainment of this condition being registered on instruments located above ground. Current will continue to flow until every spot on the pipe is covered. After removal of excess bitumen solution and flushing, main can be placed in service immediately. Lining is odorless and tasteless and does not impart color or have any other deleterious effect on water. Mains from 2 inches in diameter up may be relined by this process. Method has been successfully employed in England during past 4 years.—*R. E. Thompson* (*Courtesy Chem. Abst.*).

The Paterson Chlorograph Recorder. Eng. Contract Record, **48**: 271, April 4, 1934. Brief description of Paterson Chlorograph, which consists essentially of orifice-type flow meter, calibrated to read flow of chlorine in pounds per hour. Recording mechanism consists of diaphragm chamber connected with flow meter and with metallic aneroid cell. Fluctuations in pressure due to variations in flow are transmitted by means of special liquid from diaphragm chamber to aneroid cell, which actuates pen through suitable lever system. Chart is driven by 7-day clock. Flow is recorded with high degree of accuracy.—*R. E. Thompson.*

Directory of Water Works Officials of Canada. Eng. Contract Record, **48**: 280–9, April 4, 1934. List is given of names of engineers, superintendents, and commissioners in charge of operation of municipal water supplies in Canada, arranged in alphabetical order according to provinces.—*R. E. Thompson.*

Ozone for the Treatment of Water. Norman J. Howard. Eng. Contract Record, **48**: 266–7, 1934. In addition to its bactericidal action, ozone reduces color and improves taste of water. Color and turbidity interfere with the

sterilizing action. At present time, there are more than 80 ozone installations in successful operation in Europe; but in America its use is confined largely to the removal of taste from water used in carbonated beverage plants, probably due to the cost. It is pointed out, however, that the cost would not be much greater than the amounts at present being expended for prevention of taste with chlorination. Results obtained in an experimental plant at the works of the Metropolitan Water Board, London, England, are outlined. Cost was estimated to be about 3 times that of chloramine treatment; but it was concluded that the advantages of the method more than justified the cost.—*R. E. Thompson (Courtesy Chem. Abst.).*

City of Toronto's Facilities for Water Works Maintenance. Eng. Cont. Record, **48**: 261, April 4, 1934. Brief description of recently completed $500,000 water works maintenance building in Toronto, Ontario. Structure, which is virtually a group of various heights and layouts connected together and arranged in form of square around courtyard 84 x 88 feet, occupies full city block 332 x 213 feet. Equipment was provided for making patterns for hydrants, valves, manhole covers, etc., machining of castings, repair of distribution units, testing and repair of meters, storage of pipes, valves, and hydrants, and a large number of other operations.—*R. E. Thompson.*

What Are the Prospects in the Waterworks and Sewerage Fields? A. E. Berry. Eng. Contract Record, **48**: 263–6, April 4, 1934. Tabulation is given showing appropriations for water works and sewerage undertakings in Ontario during last 7 years and projected works are outlined. Approved expenditures for 1933 were the lowest for many years, average annual expenditure of $10,000,000 a few years ago having dropped to $2,750,000 last year. Prospects for future are more promising, a number of projects being actively considered at present time.—*R. E. Thompson.*

Activated Carbon as a Controlling Agent for Tastes and Odors in Water Supplies. R. A. Irwin. Eng. Contract Record, **48**: 268–9, 1934. It seems definitely established that a dosage of from 0.1 to 2.0 p.p.m. of activated carbon will stabilize coagulation sludge and prevent tastes due to putrefaction. In addition, coagulation is improved and the pH range for most effective flocculation widened. Use of activated carbon in conjunction with prechlorination does not nullify effectiveness of latter; carbon dosages of 2 p.p.m. do not noticeably reduce the residual chlorine. The carbon which collects on surface of filters, however, completely dechlorinates the water.—*R. E. Thompson (Courtesy Chem. Abst.).*

The Filter Plant of Toronto's $14,000,000 Duplicate Water Supply. Eng. Contract Record, **48**: 257–61, April 4, 1934. Brief, illustrated description of new filter plant under construction in Toronto, Ontario, which will ultimately consist of 40 rapid sand filters operated at rate of 105 m.g.a.d., giving total capacity of 200 m.g.d. Initially, only 20 filters will be constructed. Each filter will be 68 feet x 35 feet 7 inches, with net area of 2,103 square feet. Underdrain system has been designed to avoid shock due to changing velocities and

quantities and to provide at each orifice a uniform delivery of wash water. Orifices, $\frac{3}{4}$ inch in diameter, will be of bronze, inclined downward at 45° from current in pipes, and are spaced on 1-foot centers each way in graded gravel, top 6-inch layer of latter being cemented. Sand will have effective size of about 0.5 mm. and uniformity coefficient of 1.5, and will be 30 inches deep. Mixing period of 30 minutes and settling period of 2 hours and 50 minutes at maximum rate of flow are being provided for. Pure water reservoir, located below filters will have capacity of 12 m.g., providing minimum contact period of 1 hour and 20 minutes for the chlorine in the superchlorination method of taste prevention which will be employed. Chlorine will be applied as water enters reservoir and sulfur dioxide, for dechlorination, just prior to its exit into pure water tunnel, or high level pumping station conduits.—*R. E. Thompson.*

The Relation of Provincial Health Departments to the Development of Water Supplies. A. E. BERRY. Eng. Contract Record, **48**: 270–1, 1934. Function of provincial health departments is discussed, with particular reference to Ontario Department, which was organized in 1882. Public Health Act places responsibility for control of water supplies upon the Department of Health and confers upon it mandatory powers to enforce changes in interests of public health. Laboratory and engineering services are maintained and regular inspection of all purification plants are made. There are 279 public supplies in Ontario. Not a single case of typhoid fever, or related disease, has been traced to these supplies for a number of years. Typhoid mortality rate has been reduced to 1.7 per 100,000—*R. E. Thompson* (*Courtesy Chem. Abst.*).

A Deficient Supply of Impure Water at Exorbitant Rates. Eng. Contract Record, **48**: 590–4, July 11, 1934. Historical review of Toronto water system and comparison of present supply with that of privately owned company of earlier years, which was described as "a deficient supply of impure water furnished at exorbitant rates." There was no water works in existence when city was incorporated in 1834. In 1841, a private company was formed to develop a supply from Toronto Bay and in 1873 the plant was purchased by the city. First project undertaken by city was an infiltration basin on lake shore at Toronto Island, this being later abandoned in favor of supply taken directly from Lake Ontario. Records show that in 1881 all wells throughout city had been discarded and entire supply taken from city works. A slow sand filter plant was completed at the Island in 1911 and a second filter plant of drifting sand type in 1918. At present time there is being constructed in eastern section of city a duplicate water works, expenditure involved being approximately $14,0000,000. Supply for new plant will also be derived from Lake Ontario.—*R. E. Thompson.*

Water Supplies on Common Carriers. G. H. FERGUSON. Can. Pub. Health J., **25**: 601–2, 1934. Brief discussion of control of water supplies on common carriers in Canada.—*R. E. Thompson* (*Courtesy Chem. Abst.*).

Denver Secures PWA Loan for Water Diversion. Eng. News-Rec., 113: 730–1, December 6, 1934. After year's negotiation with PWA, Denver Board of Water Commissioners consummated lease agreement whereby $3,500,000 is to be expended on transmountain diversion of 54,600 acre-feet of water annually from headwaters of Colorado River through pioneer bore of Moffat railroad tunnel. As lease method of financing has been used on only one other PWA project, a number of difficulties arose. As finally worked out, city deeded all property and rights concerned in diversion project to PWA which in turn will lease property back to city for term of 30 years, at rental of $175,000 per year an amount sufficent to cover 4 per cent interest and amortization of rent certificates issued by city to pay for 70 percent of loan-and-grant money expended for proposed improvements. Redemption money will be derived from water revenue. Certificates are not secured by faith and credit of city. When certificates have been amortized, government will reconvey property to city, but an assignment provision will permit government to turn lease over to third party. Rates are sufficient to cover all bonded indebtedness, operation, and maintenance costs, as well as rent certificates, without preference or priority. Thus this "rent" is legally considered an expense of operation; but in effect the financing is quite similar to water revenue bonds or certificates of other cities. Water to be obtained by this project is to be secured by means of collecting ditches, tunnels, and pipe lines, 8.8 miles in total length, from watersheds of Big Vasquez Creek, Little Vasquez Creek, Fraser River, and Jim Creek, and conveyed by Moffat Tunnel pioneer bore eastward through Continental Divide. Issuing from eastern portal, water will flow in channel of South Boulder Creek to diverting dam 3 miles above Eldorado Springs. Thence water will be carried 6 miles by tunnels, siphons, and canals to natural drainage courses leading to Zang's Reservoir or Standley Lake. Water will be sold or exchanged for water in South Platte River above Denver.—*R. E. Thompson.*

NEW BOOKS

Qualités de l'Eau et Moyens de Correction. Dr. Edouard Imbeaux. 834 pp. 440 figs. 1935. Pub. Dunod, Editeur, Paris, France. It is not often that we have an opportunity to see a phase of engineering extensively compared from the international point of view. In a recent work by Dr. Edouard Imbeaux, entitled "Qualités de l'Eau et Moyens de Correction," we are afforded a most interesting opportunity to see this broad subject set forth not only as our practice goes in the United States, but also in France, England, Germany and various other parts of the world. Dr. Imbeaux is Professor of Applied Hydrology of the L'Ecole des Ponts et Chaussees, of France, and is a member of the Supreme Council of Public Health of France. His broad interest in the water supply problem led him long ago to become a member of the American Water Works Association as well. As Advisor to the Minister of War of France, in matters pertaining to water supply, a responsibility which he held during the war and which he still holds, he is well known to many Americans who dealt in water supply problems with the A. E. F. His extensive knowledge of the hydrology of France was at the service of our Army and was

indispensable to its welfare. Dr. Imbeaux' earlier books on water supply, which include "Annuaire Statistique et Descriptif des Distributions d'eau et Égouts" and "Essai d'hydrogéologie," are classics. Now comes this new one on the Quality of Water and the Means of Correction. In his efforts to present, for the benefit of French readers, the best experience in connection with American water supply work, the author has included much information which has long been every-day knowledge to American water works engineers. The interest which American engineers will find in this book is, therefore, chiefly in the extensive compilation of information of similar material from sources outside the United States and not commonly found in our literature. This, of course, will be welcome to many of us. Those interested in problems of water purification and the control of water quality will find this treatise broadly informative. In that section of the book dealing with the methods of analyzing water, there is opportunity for a comparison, of numerous different methods in use in different countries. Such comparisons, of course, have already been made extensively by laboratory workers in this part of the world, and the standard methods for water analysis of the American Public Health Association reflect much of this comparative study. The author's purpose does not seem to have been to make comparisons, since comparative results of different methods are not given, but in setting forth these numerous methods he has done a useful service to those who wish to make comparative studies of the suitability and efficiency of different methods. In American technical literature, different features of the water supply problem are largely dealt with under separate cover by different authors whose work has led them to specialize in their respective fields. Here, however, we find the Biology phase of the problem dealt with under the same cover with the Chemistry and the Engineering phases of water supply work. Likewise our literature has dealt with the water supply problem mainly from the point of view of public water supplies. The author, located in a part of the world where mineral water and mineral baths have for long been an important factor, devotes a considerable part of his volume to a discussion of this phase of the water supply problem. The author describes a large number of proprietary filters. The extent and variety of this development in Europe is interesting. On the other hand, from the earliest days of the important development of water purification plants in this country, engineers in the employ of municipalities have studied the characteristics of their problems; have recognized a certain few elements as basic; have attacked these basic elements scientifically; and then, most important of all, have exchanged views freely, have co-ordinated and unified their conclusions, and have made all this information public property to the great and lasting advantage of the country. Even those industries which specialize in the business of building water purification plants, have been ponderously influenced by this policy and conform closely to it, so that their business today consists more in the furnishing of the special mechanical appliances needed in a filtration plant of conventional engineering design, than it does in furnishing the entire plant as a ready-made mechanical unit. It is also interesting to note the large number of filters described by the author for domestic use, indicating a demand, or at least recognizing a need for means at the command of a household for purifying the water they use; a need which has

become less and less in the United States and Canada, owing to the public policy which has been pursued of making all municipal water supplies safe to drink. Under the heading of Correction of Chemical Qualities of the Water by the Removal of Oxygen, the story would have been made more complete by reference to one of the most classical cases on record, namely, the deaeration of the water which is pumped through the famous 350-mile Coolgardie pipe line in Australia, described in the Proceedings of the Institute of Civil Engineers, Vol. 162, Paper 3516, and also in the Journal of the New England Water Works Association, December 1925, page 421. In pursuing inquiries in this unusual treatise, it is not always easy to put one's finger on the subject matter he wants, through the table of contents. In view of the Author's effort to make this work comprehensive, its usefulness could have been increased if an index had been included. On the whole, this work of Dr. Imbeaux' presents a most interesting opportunity for students of the water supply problem to study the art as it is practised in many parts of the world.—*Francis F. Longley.*

Proceedings, Eighth Annual Convention, Florida Section American Water Works Association. Daytona Beach, Florida, April 16, 17, 1934. 11 x 8½ inches. Mimeogr. L. G. LENERT, Jacksonville, Florida. **New Methods of Detection for B. Coli and B. Typhosus.** R. H. CONK. 7–17. Report of laboratory study indicating value of CONRADI-DRIGALISKI Agar and Brilliant Green Eosin Agar as positive simultaneous detectors of B. Coli and B. Typhosus in drinking water. Formulas for preparation of media and procedure used in confirming results of tests are given. **Discussion** condemns use of special media in routine water works laboratories. **The Use of Maps, Records, and Graphs in Water Works Operations.** F. O. LEE. 18–23. St. Petersburg, Fla., uses a general skeleton map of entire system, showing only water works elements; sectional maps in more detail; and street intersection maps in complete detail (carried by emergency crew). Graphical presentation of operating is found useful. **Experiments and Improvements at the Fort Lauderdale Filter Plant.** C. E. FIVEASH. 24–26. Ammonia-chlorine treatment was found to be helpful in red water elimination. **Operation in the Jacksonville Meter Department.** J. E. HERRING. 28–30. Methods of maintenance and testing of 30,000 meters. **Preparation of Water for Ice Making.** L. W. CULTER. 31–34. Suitable raw water, completely treated, produces best ice. Highly soluble sulphates and chlorides are difficult of removal and freeze early in the ice cake. Less soluble carbonates separate readily in freezing process and can be removed from the core. **Manufacture, Use, and Control of Acid at Tampa Water Purification Plant.** J. E. LYLES. 35–38. Hillsboro river water, ranging from soft, highly colored to fairly hard, slightly colored water, is treated with alum and sulphurous acid for decolorization. Sulphurous acid is made at plant, using sulphur burner, cooling and settling tower, and absorption tower. Since acid is used as made, manufacturing operations must be regulated by rate of use. **Present Requirements of Railway Boiler Water Treatment.** R. C. BARDWELL. 39–47. Hard scale can be prevented by maintaining total hardness below alkalinity. Pitting and corrosion due to water quality can be held at minimum by maintaining sodium alkalinity at least 15 percent of total dissolved solids. Foaming can be avoided by adopt-

ing a blow-off schedule suited to water quality, boiler design, and load conditions. **The Trans-Florida Canal Investigation and Some Geological Problems Involved.** E. B. BURWELL., Jr. 48–53. Outline of geologic studies of ground water, being carried out to indicate relation of water table to canal gradient as affecting supply to, or leakage from, canal. **Methods of Exploring Artesian Wells in Florida.** V. T. STRINGFIELD. 54–59. Brief statement of groundwater geology in Sarasota County, and of results of exploration of artesian wells by current meters and electric resistance methods to obtain data on yields of water-bearing strata, subsurface leakage, and points of entrance of highly mineralized water. **The Use of Powdered Activated Carbon in Florida.** F. E. STUART. 60–62. Procedure for elimination of tastes and odors: seed filters at rate of 2 pounds carbon per m.g.d. filter capacity; blanket sludge in settling tanks at rate of 25 pounds of carbon per m.g.d. plant capacity; apply continuous dose as coagulant at rate of 1 p.p.m. Usually coagulant dose can be reduced to ½ p.p.m. after first filter runs.—*R. L. McNamee.*

Papers, Ninth Annual Michigan Conference on Water Purification, September 19, 20, 1934. Bulletin No. **61,** Michigan Engineering Experiment Station, East Lansing, Mich. 6 x 9 inches. Paper. 79 pp. 25 cents. **Plankton and Plankton Problems with Reference to Water Supplies.** H. J. DEASON. 5–14. "This brief survey of plankton and plankton problems is written from an academic standpoint and attempts to treat briefly the information that will be of some value to water-supply workers confronted with problems of plankton control and elimination. Mention is made of the general underlying principles of plankton production, the seasonal abundance of plankton organisms as well as the vertical and horizontal distribution of plankton on lakes. The relationship of plankton organisms to objectionable odors and tastes in water supplies is outlined. Some successful methods of plankton control and elimination are enumerated without evaluation or recommendation. Methods of collection and laboratory study of plankton are described briefly."—Author's summary. Bibliography. **Zeolites: Mining, Processing, Manufacture, and Uses.** ESKEL NORDELL. 15–25. History of use of zeolites, manufacture of synthetic zeolites, mining and processing of greensand, and benefits of this type of water softening are discussed. **East Lansing Softening and Iron Removal Plant.** C. R. ERICKSON. 26–30. Municipal plant of 1-m.g.d. capacity consists of 5 sodium zeolite pressure units and 2 manganese zeolite pressure units. Seventy-five per cent of water is passed through sodium units, 25 per cent through manganese units, and effluents are combined. From raw water of 326 total hardness, 310 total alkalinity, and 1.0 iron, is produced an effluent of 80–90 total hardness and 0.1 iron (all in p.p.m.). Brine recovery system will reduce salt consumption to 0.3 pounds salt per 1000 grains of hardness removed. **Activated Carbon Tests.** IRVING DAHLJELM. 31–33. Report on relative values of four unnamed carbons as determined by tests for adsorption, dispersive power, suspensibility, and apparent density. One brand exceeded all others in all tests. **Sand and Gravel Treatment at Midland.** PAUL STEGEMAN. 34–35. Gravel bed of filter in lime softening plant, found to be more encrusted than sand bed, was cleaned with commercial HCl. Reduction of sand bed

thickness from 30 to 18 inches increased filter rate from 115 to 185 m.g.a.d. **Ammonia and High Bacterial Counts.** C. H. BURDICK. 36–38. Experience at Flint suggests the existence of a type of nitrifying bacterium able to utilize and thrive on chlorine. **Nitrifying Bacteria in Water Supplies.** DOUGLAS FEBEN. 39–45. Great Lakes waters (and presumably all surface waters) definitely contain nitrifying bacteria of an undetermined species, for which simple and direct methods of artificial propagation are available. "Sand filtration after ammoniation promotes their growth during suitable water temperatures to a point where the chloramine process defeats its own purpose and becomes costly through the wasting of both ammonia, to feed the bacteria, and chlorine, to oxidize their products. Their resistance makes it appear impossible, or impracticable, to control nitrification by chlorination." **Practical Notes on Handling Chlorine and Ammonia.** J. M. POTTER. 46–56. Properties of chlorine in liquid and gaseous state, types of containers available, proper details of piping, nature of, and remedies for, machine difficulties, and rules for first aid in case of accident are discussed. **Maintenance of Chlorine Gas Masks at Detroit, Michigan.** J. A. PARKS. 57–59. Burrell Industrial mask equipped with "GMB" canister, kept outside chlorine rooms, is checked every four months. Life of canister is set at 2 hours use. **The Installation, Operation and Maintenance of Mechanical Pumping Plant Equipment.** B. J. MULLEN. 60–67. Foundations, adjustment of suction and discharge connections, and arrangement of priming connections require special attention during installation. Starting and shutting down of units, lubrication, and adjustment of load to efficient point on pump characteristic curve, must be watched during operation. Careful records of maintenance service should be kept for each unit. **Installation and Maintenance of Electrical Pumping Plant Equipment.** C. J. SCHOENINGER. 68–73. Discussion of safety precautions and of care of control equipment, relays, switch gear, controllers and switches, insulation, and motors and brushes.—*R. L. McNamee.*

Procedure Handbook of Arc Welding Design and Practice. Flexible fabrikoid: 6 x 9 inches; pp. 434. Published by The Lincoln Electric Co., Cleveland, Ohio. $1.50. Reviewed in Eng. News-Rec., **111**: 790, December 28, 1933.—*R. E. Thompson.*

The Water Engineer's Handbook and Directory, 1933. London: Water and Water Engineering. 8s. 6d. From Chem. Abst., **27**: 2235, May 10, 1933.—*R. E. Thompson.*

The Examination of Waters and Water Supplies. JOHN C. THRESH. 4th ed. revised. London: J. and A. Churchill. 842 pp. 42s. From Chem. Abst., **27**: 2746, June 10, 1933.—*R. E. Thompson.*

Die physikalische Chemie der Kesselsteinbildung und ihre Verhütung. R. STUMPER. 2nd. edition, revised. Stuttgart: F. Enke. About 72 pp. About M.6. From Chem. Abst., **27**: 3274, July 10, 1933.—*R. E. Thompson.*

Water Supplies of the Federated Malay States. R. W. BLAIR. Bull. from the Inst. for Medical Research, Federated Malay States, No. 2 of 1933. Kuala Lumpur: Kyle, Palmer and Co., Ltd. 162 pp. From Chem. Abst., **27**: 5453, November 10, 1933.—*R. E. Thompson.*

Third Report of the Scottish Advisory Committee on Rivers Pollution Prevention. WILLIAM E. WHYTE, et al. **Rivers Leven and Ore (Fife).** Edinburgh: H. M. Stationery Office. 46 pp. From Chem. Abst., **28**: 846, February 10, 1934.—*R. E. Thompson.*

The Control of Water Softening and Boiler Water Conditioning. London: Imperial Chem. Industries, Ltd. 39 pp. From Chem. Abst., **28**: 2087, April 10, 1934.—*R. E. Thompson.*